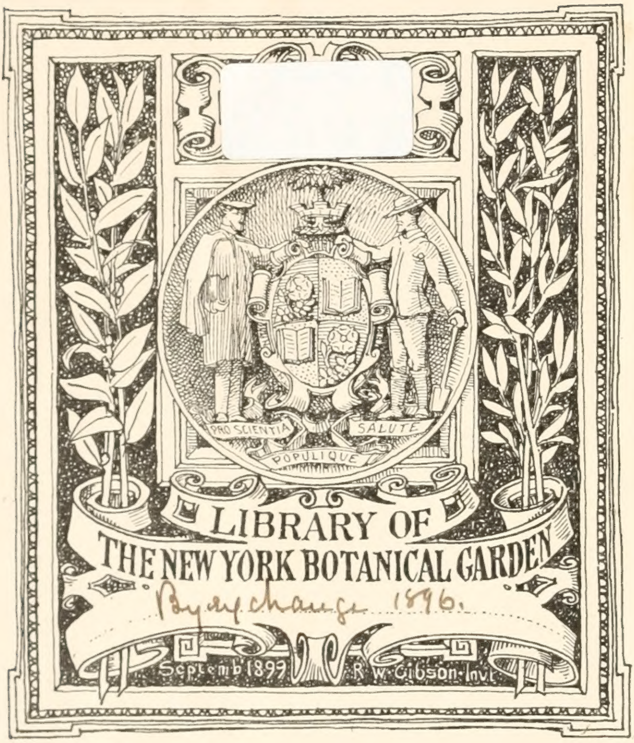

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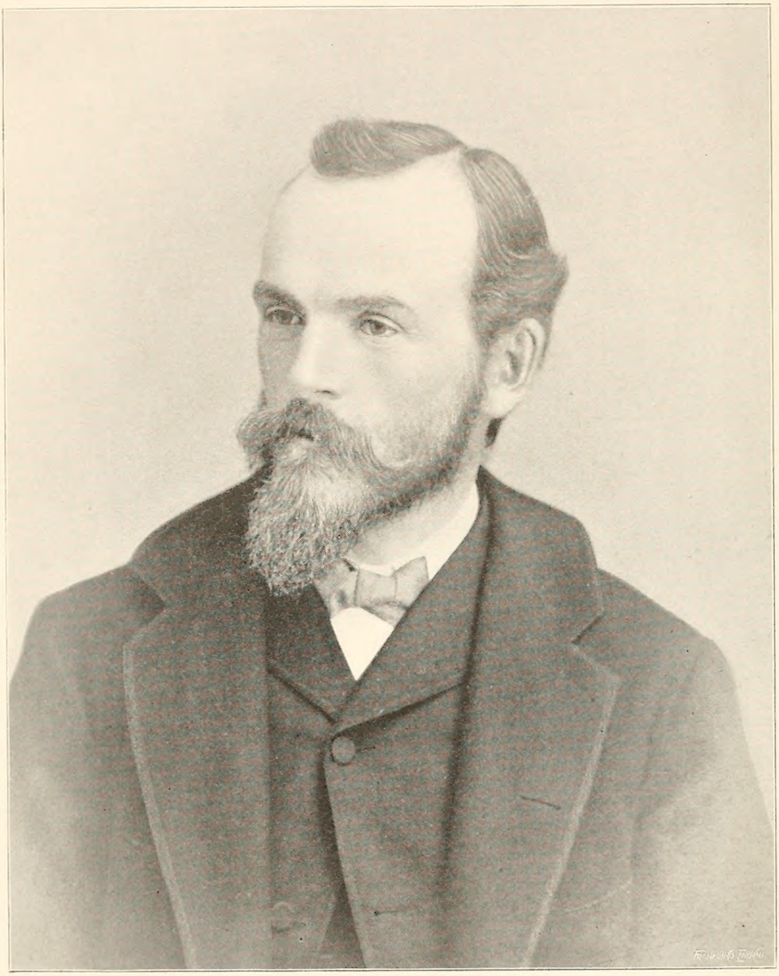

H. G. Reynolds

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HENRY G. REYNOLDS.

Henry G. Reynolds was born in Buffalo, New York, in 1850. During his boyhood the years were spent in Chicago, where his father was engaged in trade. His preparation for college was made in the schools of Chicago.

Mr. Reynolds entered the Michigan Agricultural College and graduated in the class of 1870. Prof. Wm. K. Kedzie, Hon. George A. Farr and Chas. W. Garfield were among his classmates. He was a painstaking student, always standing high in his classes, and, although city-bred and entirely unused to manual labor on the farm or in the garden, he took great pride in his acquirements on the labor side of his student life, and has been to this day an enthusiastic exponent of field labor as a part of the training of Agricultural College men. After taking his Bachelor's degree he was appointed foreman in the Department of Horticulture under Prof. W. W. Tracy, with whom in 1871 he formed a copartnership and purchased a farm at Old Mission, Grand Traverse county, Michigan; the purpose being to develop a fruit farm, and establish with it method of working up surplus fruit into manufactured products. The location was chosen not only because of its apparent adaptation to a wide range of fruit but for the reason that the climate was desirable for one who had such precarious health as Mr. Reynolds had endured from his birth to manhood.

Mr. Tracy located on the farm and began its development along the lines before determined, and Mr. Reynolds went to Europe, spending most of two years in the study of the German language and sciences that would naturally aid him in the chosen life pursuit. Returning in 1873 he spent some time with Mr. Tracy in developing some features of the farm, and in 1874 was married to Miss Fannie Llewellyn. The wedding trip was a journey abroad, and most of the following year was spent in travel. Returning Mr. and Mrs. Reynolds settled down to a most delightful home life at Old Mission.

In 1879 Mr. Reynolds was appointed a member of the State Board of Agriculture, and for the six years following he rarely missed a meeting of the Board. He was devoted to the interests of the Agricultural College, and his services were so thoroughly appreciated by his associates that upon the death of Sec. R. G. Baird he was unanimously chosen as Secretary of the Board and the College. His intimate knowledge of the College work and his adaptability to the management of the finances of the institution led the Board to very soon rely upon him as the financier of the College. He brought to the office such equipment for its work that his counsel was of inestimable value, and the details of his office were so well in hand that at any moment the Board could know from his statement what course to pursue with regard to any proposed plan involving the expenditure of money. He became the business manager of the institution.

In 1891 Mr. Reynolds' health became quite uncertain and caused a great deal of anxiety on the part of his family and near friends. He took a vacation from office work and tramped through portions of New England, hoping the change and relief from the grind of every day college duties would enable him to recuperate. There did seem to be a renewal of strength, but in the spring and early summer of 1892 his nervous difficulty seemed to grow upon him, and he used his hand in writing with some difficulty.

In June of this year he became very anxious about the condition of his very near friend, Chas. W. Garfield, and advised for him a trip to Europe, suggesting as an inducement that if possible to arrange for a leave of absence he would be a companion on the trip. Within a week the details were arranged, and with his son, Llewellyn, and a friend, Mr. O. C. Simonds, of Chicago, as additional companions, he made a rapid bicycle tour of Scotland, England, Holland, Germany, Switzerland and France, returning in November. He gained in vigor and seemed to have taken a new lease of life, but very soon upon again settling back into official work the gain slipped away, and in the spring of 1893 he was quite rapidly declining and his friends became very anxious for him, and under what proved to be wise counsel he reluctantly retired from the work and the associations he had so greatly enjoyed. In the autumn of 1893 he removed with his family to California, and is now permanently located at Pasadena upon a fruit farm, and, greatly to the joy of all his army of friends, has recovered a good measure of health. The impress of Mr. Reynolds' judgment is seen in many departments of college life, and one of the last important matters come from his hand was the draft of the present law under which the entire management of the College lands was placed in the State Board of Agriculture.

Mr. Reynolds is a home lover, and with his estimable wife has built up a household that is a model of excellence. He believes in agricultural education as outlined in the organic act under which our College is established. He opposes strenuously any measures that in his opinion tend to weaken the leading purpose of the College, to wit: The education of farmers. Two of his sons will graduate next year from the tuition of his own Alma Mater.

Mr. Reynolds is a man of decided opinions. While tolerant of others who may differ from him and always courteous he maintains his own views with earnestness and persistence. He is naturally combative and will fight for what he believes to be right to the end. But is always open to conviction and has modified his views upon leading questions of politics and economies, always maintaining that in the evolution of manhood true progress compels a modification of one's belief. To his friends he is intensely loyal and never hesitates to stand by them in an emergency. Enemies, he has none, for his absolute honesty even in his antagonism commands respect and breeds confidence. His friends are all rejoiced at his recovery of health and strength and wish him many years of happiness with his family in the State of his adoption. His portrait is placed as a frontispiece in this volume by the State Board of Agriculture as a tribute of respect and a record of its appreciation of the labors of Mr. Reynolds in behalf of the State Board of Agriculture and the Michigan Agricultural College.

THIRTY-SECOND ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE BOARD OF AGRICULTURE

OF THE

STATE OF MICHIGAN

FROM

JULY 1, 1892, TO JUNE 30, 1893.

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REPORT OF THE SECRETARY

OF THE

STATE BOARD OF AGRICULTURE

AGRICULTURAL COLLEGE,
July 1, 1893.

TO HON. JOHN T. RICH,
Governor of the State of Michigan:

SIR—I have the honor to submit to you herewith, as required by statute, the accompanying report for the fiscal year ending June 30, 1893, with supplementary papers.

Very respectfully,
IRA H. BUTTERFIELD,
Secretary of the State Board of Agriculture.

STATE BOARD OF AGRICULTURE.

	Term expires.
Hon. FRANKLIN WELLS, Constantine,	1895
President of the Board.	
Hon. CHAS. W. GARFIELD, Grand Rapids,	1899
†Hon. I. H. BUTTERFIELD, Lapeer,	1899
Hon. A. C. GLIDDEN, Paw Paw,	1895
Hon. HENRY CHAMBERLAIN, Three Oaks,	1897
Hon. EDWIN PHELPS, Pontiac,	1897
Hon. JOHN T. RICH, Governor of the State,	*Ex Officio.*
Hon. LEWIS G. GORTON, President of the College,	

*HENRY G. REYNOLDS, M. S., Agricultural College, Secretary.
BENJAMIN F. DAVIS, Lansing, Treasurer.

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* Resigned June 30, 1893.
† Appointed secretary July 1, 1893.

STANDING COMMITTEES.

The President of the Board is *ex officio* a member of each of the Standing Committees:

Finance,	C. W. Garfield, A. C. Glidden.
Farm Management,	I. H. Butterfield, E. Phelps.
Botany and Horticulture,	C. W. Garfield, E. Phelps.
Buildings and Property,	A. C. Glidden, I. H. Butterfield.
Employees,	H. Chamberlain, A. C. Glidden, O. Clute.
Farmers' Institutes,	A. C. Glidden, C. W. Garfield, O. Clute.
Mechanics,	H. Chamberlain, C. W. Garfield.
Veterinary Dep't,	E. Phelps, I. H. Butterfield.
College Land Grant,	E. Phelps, H. Chamberlain.
Military Dep't,	C. W. Garfield, I, H. Butterfield.
State Weather Service,	A. C. Glidden, C. W. Garfield.
Experiment Station,	I. H. Butterfield, H. Chamberlain.

AGRICULTURAL EXPERIMENT STATION.

OF THE

STATE AGRICULTURAL COLLEGE.

[Under control of the State Board of Agriculture.]

STATION COUNCIL.

O. CLUTE, M. S., - - - - - - - Director.

P. M. HARWOOD, B. S.,	Agriculturist.	ROBT. C. KEDZIE, M. A., M. D.,	Chemist.
L. R. TAFT, M. S.,	Horticulturist.	HENRY G. REYNOLDS, M. S.,	Sec. and Treas.

ADVISORY AND ASSISTANT STAFF.

*P. G. HOLDEN, B. S.,	Asst. Agriculturist.	G. C. DAVIS, M. S.,	Consulting Zoölogist.
F. B. MUMFORD, B. S.,	Asst. in Agriculture.	E. A. A. GRANGE, V. S.,	" Veterinarian.
H. P. GLADDEN, B. S.,	" Horticulture.	CHAS. F. WHEELER, B. S.,	" Botanist.
R. J. CORYELL, B. S.,	" Horticulture.	L. A. CLINTON, B. S.,	Asst. to Director.
W. L. ROSSMAN, B. S.,	" Chemistry.	MRS. L. E. LANDON,	Librarian.
H. E. HARRISON, B. S.,	" Chemistry.		

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* Resigned April, 1893.

SUB-STATIONS.

Grayling, Crawford county, 80 acres deeded; Local Agent, Dr. O. Palmer.

South Haven, Van Buren county, 10 acres rented; 5 acres deeded; Local Agent, T. T. Lyon, President State Horticultural Society.

STATE WEATHER SERVICE.

[Under control of the State Board of Agriculture.]

OFFICERS OF THE SERVICE.

DIRECTOR,	Edward A. Evans, U. S. Weather Service, Detroit.
ASSISTANT,	E. H. Nimmo, Detroit.

STANDING COMMITTEE IN CHARGE.

HON. A. C. GLIDDEN,	Paw Paw.
HON. CHAS. W. GARFIELD,	Grand Rapids.

STATE AGRICULTURAL COLLEGE.

[UNDER CONTROL OF THE STATE BOARD OF AGRICULTURE.]

FACULTY AND OTHER OFFICERS.

O. Clute, M. S., President; [a] Feb. 25, '63; [b c] May 25, '89.

Theophilus C. Abbot, LL. D., Emeritus Professor of Mental Philosophy and Logic; [a b] Feb. 5, '58; [c] July 1, '85. Died Nov. 7, '92.

Robert C. Kedzie, M. A., M. D., Professor of Chemistry and Curator of the Chemical Laboratory; [a b c] Feb. 25, '63.

Albert J. Cook, M. S., Professor of Zoölogy and Entomology and Curator of the General Museum; [a b] Jan. 1, '67; [c] Nov. 10, '68.

Wm. J. Beal, M. A., Ph. D., Professor of Botany and Forestry and Curator of the Botanical Museum; [a b] July 9, '70; [c] Feb. 22, '71.

E. A. A. Grange, V. S., Professor of Veterinary Science; [a b c] May 22, 1883.

Henry G. Reynolds, M. S., Secretary; [a] Nov. 15, '70; [b] June 11, '85; [c] Aug. 5, '85. Resigned June 30, '93.

Levi R. Taft, M. S., Professor of Horticulture and Landscape Gardening, and Superintendent of the Horticultural Department, [a b c] Aug. 1, '88.

Howard Edwards, M. A., LL. D., Professor of English Literature and Modern Languages; [a b c] Aug. 25, '90.

Frank S. Kedzie, M. S., Adjunct Professor of Chemistry; [a b] Sept. 15, '80; [c] Jan. 1, '91.

Lester P. Breckenridge, Ph. B., Professor of Mechanical Engineering and Director of the Shops; [a b c] Aug. 24, '91.

Herman K. Vedder, C. E., Professor of Mathematics and Civil Engineering; [a b c] Sept. 15, '91.

P. Mirick Harwood, B. S., Professor of Practical Agriculture and Superintendent of the Farm; [a b c] Feb. 1, '92.

Edson A. Lewis, 2d Lieut. 18th Infantry, U. S. Army, Professor of Military Science and Tactics; [a b c] June 20, '92.

Philip B. Woodworth, B. S., M. E., Assistant Professor of Physics; [a b] May 22, '87; [c] Aug. 7, '89.

Alvin B. Noble, Ph. B., Assistant Professor of English Literature and Modern Languages; [a b c] Sept. 1, '89.

William S. Holdsworth, B. S., Assistant Professor of Drawing; [a] Feb. 22, '81; [b] Aug. 22, '87; [c] Jan. 1, '90.

Jas. S. McBride, Assistant Professor of History and Political Economy; [a b] Aug. 20, '92; [d] May 1, '93.

EDGAR A. BURNETT, B. S., Assistant Professor of Agriculture and Instructor in Animal Industry; [a,b] Aug. 10, '89; [c] Aug. 24, '91; [d] Apr. 20, '93.

FRED W. MCNAIR, B. S., Assistant Professor of Mathematics; [a,b,c] Jan. 1, '92.

CHAS. F. WHEELER, B. S., Instructor in Botany; [a,b] March 1, '90; [c] Jan. 1, '91; [e] May 1, '92.

GILBERT H. HICKS, B. S., Instructor in Botany; [a,b,c] June 6, '91.

WARREN BABCOCK, Jr., B. S., Instructor in Mathematics; [a,b,c] June 20, '91.

GEORGE A. GOODENOUGH, B. S., Instructor in Mechanics; [a,b,c] Aug. 24, '91.

WILBUR O. HEDRICK, B. S., Instructor in English; [a,b,c] Aug. 24, '91.

WILLIAM H. VANDERVOORT, B. S., Foreman of the Iron Shops; [a,b,c] Nov. 1, '89.

ALFRED G. GULLEY, M. S., Foreman of the Horticultural Department; [a,b,c] Mar. 1, '90.

ALBERT R. CURTISS, Foreman of the Wood Shops; [a,b,c] Aug. 25, '90.

E. A. EDGERTON, Engineer; [a,b,c] Mar. 25, '91.

MRS. LINDA E. LANDON, Librarian; [a,b,c] Aug. 24, '91.

KENYON L. BUTTERFIELD, B. S., Assistant Secretary; [a,b,c] Oct. 1, '91; [d] Apr. 1, '92.

THOMAS GUNSON, Foreman of Greenhouses; [a,b] Apr. 1, '91; [c] Sept. 1, '91.

JOSEPH MCCRACKEN, Foreman of the Farm; [a,b,c] Feb. 15, '92.

WALTER D. GROESBECK, B. S., Assistant Secretary; [a,b,c] Apr. 9, '92; [d] Feb. 1, '93.

OSCAR CLUTE, [a,b,c] Feb. 1, '93.

ERNEST WITTSLOCK, Foreman of Farm; [a,b,c] Feb. 2, '93.

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[a] First appointment.
[b] Present appointment.
[c] Present title.
[d] Resignation.
[e] Transferred to experiment station staff.

ACCOUNTS OF THE STATE AGRICULTURAL COLLEGE.

FOR THE FISCAL YEAR ENDING JUNE 30, 1893.

SECRETARY'S ACCOUNT.

			Dr.	Cr.
July 1, 1892.	To cash on hand		$753 19	
" 1, 1892.	To cash on deposit with college treasurer, less $3,548.38 outstanding warrants		4,679 26	
" 1, 1892.	By balance due students on deposit accounts			$3,956 79
" 1, 1892.	By overdraft on New York Bank			1,145 27
June 30, 1893.	To special appropriation receipts, per Table No. 2, page 10:			
	From State Treasurer	$30,490 00		
	From United States Treasurer	15,000 00		
	From institution	2,056 49		
			47,546 49	
June 30, 1893.	By special appropriation disbursements, per page 10			39,145 18
" 30, 1893.	To current account receipts, per table No. 3, page 11:			
	From State Treasurer	$51,600 34		
	From United States Treasurer	18,000 00		
	From institution	12,740 14		
	From institution on building account	1,877 16		
			84,217 64	
June 30, 1893.	By current account disbursements, per table No. 3, page 11:			
	General current account	$69,648 29		
	Current building account	5,193 98		
				74,842 27
June 30, 1893.	To balance due students on deposits		3,159 90	
" 30, 1893.	By cash on deposit with college treasurer, less $1,927.46 outstanding warrants			17,813 26
" 30, 1893.	By cash on deposit with New York Bank			365 98
" 30, 1893.	By cash on hand			3,087 73
			$140,356 48	$140,356 48

TABLE No 1.—*Tabular exhibit of Secretary's account.*

Name of account.	Balance sheet, July 1, 1892.		Transactions July 1, 1892, to June 30, 1893.		Balance sheet, June 30, 1893.	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Cash		$392 08	*$3,845 79		$3,453 71	
College treasurer	†$4,679 26		*13,134 00		†17,813 26	
Students' deposits		3,956 79	*796 89			$3,159 90
Special appropriations		2,414 96	39,145 18	$47,546 49		10,816 27
Current building account	347 58		5,193 98	1,877 16	3,664 40	
Current general account	1,736 99		69,648 29	82,340 48		10,955 20
Totals	$6,763 83	$6,763 83	$131,764 13	$131,764 13	$24,931 37	$24,931 37

* Balance of Dr. and Cr. transactions.

† Treasurer's statement is greater July 1, 1892, by $3,548.38, and June 30, 1893, by $1,927.46 warrants outstanding.

TREASURER'S ACCOUNT.

	Dr.	Cr.
Balance, July 1, 1892	$8,227 64	
Receipts from State Treasurer and Secretary of State Board of Agriculture	135,684 76	
Interest on deposits, 12 months, at 4 per cent	573 19	
Warrants paid from July 1, 1892, to June 30, 1893		$124,744 87
Balance on hand June 30, 1893		19,740 72
	$144,485 59	$144,485 59

B. F. DAVIS, *Treasurer.*

TABLE NO. 2.—*Statement of special appropriation account for fiscal year July 1, 1892, to June 30, 1893.*

Name of appropriation.	Balance of account, July 1, 1892.		Receipts during fiscal year.		Total available.	Total expended.	Balance of account, June 30, 1893.		Total appropriation for 1893-4.	Balance of appropriation in State Treasury, June 30, 1893.
	Dr.	Cr.	From State Treasurer.	From institution.			Dr.	Cr.		
Rebuilding greenhouse		$1,668 45	$2,500 00	$19 44	$4,187 89	$4,187 89				
Farm department		567 01			567 01	567 01				
Horticultural department		108 78			108 78	104 29		$4 49		
Greenhouse		135 51			135 51	135 51				
Veterinary department		23 05	50 00		73 05	73 05				
Chemical department	$2 16		250 00		247 84	247 84				
Zoölogical department		134 11			134 11	134 11				
English department	12 25		100 00		87 75	87 75				
Military department		51 13			51 13	51 13				
Library		203 46	1,000 00		1,203 46	214 71		988 75	$2,000 00	$1,000 00
Drafting department	190 00		190 00							
Repair of buildings, steam, and water works	921 90		7,000 00		6,078 10	1,406 79		4,671 31	10,000 00	5,000 00
Student labor (see table No. 9, page 13)	188 26		8,000 00		7,811 74	4,897 31		2,914 43	8,000 00	4,000 00
Rebuilding botanical laboratory		219 70	7,500 00		7,719 70	7,719 70				
Garden team			200 00		200 00			200 00	200 00	
Farm team			200 00		200 00			200 00	200 00	
Farm fencing			200 00		200 00			200 00	200 00	
Equipping botanical laboratory			1,000 00		1,000 00	158 46		841 54	1,000 00	
Blacksmith shop and foundry			1,500 00		1,500 00			1,500 00	1,500 00	
Addition to horticultural dwelling			500 00		500 00			500 00	500 00	
Wells hall privy			300 00		300 00	9 00		291 00	300 00	
Experiment station (see table No. 4, page 11)		618 33	*15,000 00	2,037 05	17,655 38	18,150 63	$495 25		†30,000 00	30,000 00
Balances	2,414 96						10,816 27			
Farmers' institutes						1,000 00	1,000 00		4,000 00	4,000 00
Drainage									500 00	500 00
Equipping agricultural laboratory									500 00	500 00
Walks and roads									3,500 00	3,500 00
Hospital									2,500 00	2,500 00
Sewerage									1,000 00	1,000 00
Library gallery									800 00	800 00
Mechanical department									500 00	500 00
Museum cases									225 00	225 00
Additional sheds									300 00	300 00
Total	$3,729 53	$3,729 53	$45,490 00	$2,055 49	$49,961 45	$39,015 18	$12,311 52	$12,311 52	$67,725 00	$55,825 00

* $15,000 from U. S. treasury.

† $30,000 from U. S. treasury.

TABLE No. 3.—*Current account July 1, 1892, to June 30, 1893.*

On account of—	Dr. To dibursements.	Cr. By receipts.
United States Treasurer, fourth annual payment under act of congress of August 30, 1890		$18.000 00
State Treasurer, interest on proceeds of sales of U. S. land grant, see table No. 13, page 16		51,600 34
Students' room rent and class fees, per table No. 8		5,952 61
Students' sundry fees, credited to building account, per table No. 8		1,230 35
Salaries paid	$32,817 60	
Farm departmant, see table No. 6, page 12	6,635 82	4,730 53
Horticultural department, see table No. 7, page 13	3,878 24	1,320 36
Mechanical department	2,779 07	156 31
Heating, lighting and cleaning	9,537 81	509 75
Academic departments	6,771 75	15 00
Offices, postage, stationery, advertising and sundry	7,228 00	55 58
State swamp land grant sale, credited to building account		10 50
Interest and exchange, credited to building account		605 89
Building account	5,193 98	30 42
Totals	$74,842 27	$84,217 64
Balance at beginning of period, July 1, 1892	2,084 57	
Balance at close of period, June 30, 1893	7,290 80	
Footings	$84,211 64	$84,217 64

TABLE No. 4.—*Experiment station account, July 1, 1892, to June 30, 1893.**

On account of—	Dr. To disbursements.	Cr. By receipts.
Balance from last fiscal year		$618 33
U. S. treasurer for fiscal year		15,000 00
Fertilizer license fees and expenses	$65 90	1,000 00
Salaries	8,677 76	
Farm department	1,883 20	858 35
Horticultural department	325 66	3 75
Chemical department	293 54	
Botanical department	87 33	
Zoölogical department	39 47	
Veterinary department	438 48	
Buildings	2,752 35	
Library	500 68	
Weather service	113 45	
Offices, etc.	376 73	54 05
Grayling station	967 93	
South Haven station	1,680 67	
Other outlying stations	15 00	
Apiary	32 48	120 90
Balance overdrawn		495 25
Totals	$18,150 63	$18,150 63

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* For fuller details of this account see the special report of the experiment station in the body of this volume.

TABLE No. 5.—*Employés and salaries.*

	Paid from—			Total.
	Current account.	Experiment station account.	Other sources.	
President, dwelling and	$2,700 00	$500 00		$3,200 00
One professor, dwelling and	1,700 00	300 00		2,000 00
Two professors, dwelling and $1,800 each	2,400 00	1,200 00		3,600 00
Five professors, dwelling and $1,800 each	9,000 00			9,000 00
One professor	1,800 00			1,800 00
*One professor, dwelling and			$1,800 00	1,800 00
One professor	1,200 00	300 00		1,500 00
Six assistant professors, rooms and $1,000 each	6,000 00			6,000 00
One instructor, rooms and	750 00			750 00
One instructor	900 00			900 00
Three instructors, rooms and $500 each	1,500 00			1,500 00
§ Secretary, dwelling and	300 00	500 00	1,000 00	1,800 00
Assistant secretary, room and	600 00			600 00
Librarian, rooms and	505 00	120 00		625 00
Foreman of farm, dwelling, board and	600 00			600 00
Foreman of garden, rooms and	750 00			750 00
Foreman of iron shop, room and	500 00			500 00
Foreman of wood shop	750 00			750 00
Florist, dwelling and	540 00			540 00
One assistant florist, rooms and	360 00			360 00
One consulting botanist, rooms and		1,000 00		1,000 00
One consulting entomologist, room and		800 00		800 00
Four assistants in experiments, rooms and $500 each		2,000 00		2,000 00
One assistant in experiments, room and		600 00		600 00
One assistant in experiments, room and		300 00		300 00
One assistant in experiments, rooms and		1,000 00		1,000 00
Engineer, dwelling and	600 00			600 00
Fireman	360 00			360 00
Herdsman, room, board and	420 00			420 00
Two janitors, rooms and	648 00			648 00
One clerk in mechanical department, room and	420 00			420 00
Totals	$35,303 00	$8,620 00	$2,800 00	$46,723 00

* Army officer detailed as Professor of Military Science and Tactics. Salary paid by U. S. Government.
§ $1,000 of salary as Secretary of the Board of Agriculture is paid from the State treasury.

TABLE No. 6.—*Account with Farm Department.*

On account of—	Dr. To disbursements.	Cr. By receipts.
Labor and team, aside from student labor	$2,855 18	$252 37
Farm house	1,271 80	48 49
Cattle	724 61	1,768 52
Sheep	93 14	94 14
Swine	1 00	155 52
Grain	26 40	15 75
Produce		447 61
Implements and repairs	552 21	1 50
Wood	1 50	1,924 23
Office, etc.	662 09	22 40
Drains	213 44	
Seeds	99 55	
Fence	134 90	
Balance		1,905 29
Footings	$6,635 82	$6,635 82

TABLE No. 7.—*Account with Horticultural Department, including greenhouse.*

On account of—	Dr. To disbursements.	Cr. By receipts.
Labor, aside from student labor	$2,434 66	
Team	260 18	
Grounds	403 85	
Freight	67 29	
Implements and repairs	238 12	
Seeds and plants	186 46	
Ice	47 75	
Office, etc.	239 93	
Sundry receipts		$927 97
Greenhouse receipts		392 39
Balance		2,557 88
Footings	$3,878 24	$3,878 24

TABLE No. 8.—*Students' fees.*

On account of—	Current account, general.	Current account, building.	Total.
Room rent	$3,153 59		$3,153 59
Incidental expense fee	1,930 00		1,930 00
Physiological dissection fee	34 65		34 65
Veterinary dissection fee	10 50		10 50
Chemical analysis fee	404 20		404 20
Damages		$3 35	3 35
Special examination fee		187 00	187 00
Matriculation fee		655 00	655 00
Diploma fee		125 00	125 00
Tuition fee from non-resident students		260 00	260 00
Medical fee	412 50		412 50
Physical fee	7 17		7 17
Totals	$5,952 61	$1,230 35	$7,182 96

TABLE No. 9.—*Student Labor.—Account of wages paid for twelve months, July 1, 1892, to June 30, 1893.*

On account of—	Student labor.	Experiment station.	Total.
Farm department	$1,537 84	$1 84	$1,539 18
Horticultural department	1,601 07		1,601 07
Mechanical department, repairs and heating	456 81		456 81
Signal flags	6 90		6 90
Bell ringing, choir, etc.	180 48		180 48
Janitor	350 78		350 78
Offices	22 10	1 60	23 70
Veterinary department	48 12		48 12
Zoölogical department	120 30		120 30
Botanical department	100 44		100 44
Physical department	86 85		86 85
Drafting department	1 44		1 44
Military department	161 88		161 88
Library	200 38	2 72	203 10
Engineering department	15 76		15 76
Totals	$4,875 39	$6 16	$4,897 31

TABLE No. 10.—*Agricultural College lands, United States grant of 1862, record of sales and forfeitures to the present time.*

Year.	Original sales.			Forfeited lands resold.			Total sales.			Number of acres reverting by forfeiture.	Aggregate of sales, less forfeitures to end of each year. Acres.	Balance remaining vacant at end of each year. Acres.
	Acres.	Average price per acre.	Amount.	Acres.	Average price per acre.	Amount.	Acres.	Average price per acre.	Amount.			
1867												235,682.46
1868	520.	$5 00	$2,600 00				520.	$5 00	$2,600 00		520.	235,162 46
1869	13,480.	3 19	43,000 00				13,480.	3 19	43,000 00		14,000.	221,682.46
1870	3,280.	3 44	11,280 00				3,280.00	3 44	11,280 00		17,280.	218,402.46
1871	9,372.44	3 37	31,637 32				9,372.44	3 37	31,637 32		26,652.44	209,030.02
1872	20,580.25	3 19	65,660 75				20,580.25	3 19	65,660 75		47,232.69	188,449.77
1873	17,205.89	3 15	54,177 67	40.	$3 62	$145 00	17,245.89	3 15	54,322 67	40.	64,438.58	171,243.88
1874	2,039.95	3 20	6,519 75	40.	3 00	120 00	2,079.95	3 19	6,639 75	638.72	65,879.81	169,802.65
1875	4,798.99	3 08	14,796 97	40.	3 00	120 00	4,838.99	3 08	14,916 97	560.	70,158.80	165,523.66
1876	1,953.73	3 12	6,101 19	520.	4 38	2,280 00	2,473.73	3 39	8,381 19	1,758.40	70,874.13	164,808.33
1877	1,634.75	3 00	4,904 25	200.	3 00	600 00	1,834.75	3 00	5,504 25	1,438.06	71,270.82	164,411.64
1878	4,034.80	3 10	12,504 40	1,135.73	3 91	4,443 65	5,170.53	3 28	16,948 05	2,415.73	74,025.62	161,656 84
1879	6,782.12	3 02	20,506 36	1,318.06	3 08	4,054 18	8,100.18	3 03	24,560 54	1,978.11	80,147.69	155,534.77
1880	8,826.56	3 03	26,729 08	280.	3 18	890 00	9,106.56	3 03	27,619 58	4,926.33	84,327.92	151,354.54
1881	6,168.97	3 96	24,447 25	360.	4 33	1,560 00	6,528.97	3 98	26,007 25	1,987.19	88,869.70	146,812.76
1882	10,225.99	5 00	51,129 95	1,637.01	5 09	8,335 05	11,863.	5 01	49,465 00	760.11	99,972.59	135,709.87
1883	7,035.57	5 00	35,177 85	1,680.	5 03	8,448 00	8,715.57	5 00	43,625 85	560.	108,128.16	127,554.30
1884	1,846.01	5 09	9,390 05	526 45	5 38	2,832 25	2,372.46	5 15	12,222 30	200.	110,300.62	125,381.84
1885	704.88	5 74	4,044 40	119.52	5 67	677 60	824.40	5 73	4,722 00	525.47	110,599.55	125,082.91
1886	720.00	5 83	4,200 00	560.	5 78	3,240 00	1,280.00	5 81	7,440 00	440.	111,439.55	124,242.91
1887	1,718.27	6 45	11,091 35	320.	5 00	1,600 00	2,038.27	6 23	12,691 35	200.	113,277.82	122,404.64
1888	2,031.18	6 02	12,235 90	160.	5 00	800 00	2,191.18	5 95	13,035 90	640.	114,829.00	120,853.46
1889	1,000.28	6 64	6,641 40	40.	5 00	200 00	1,040.28	6 58	6,841 40	120.	115,749.28	* 119,585.86
1890	2,674.70	8 06	21,561 88				2,674.70	8 06	21,561 88	480.	117,943 98	117,391.16
1891	2,614.66	8 26	21,593 02	480.	6 47	3,105 00	3,094.66	7 98	24,698 02	920.	120,118.64	115,216.50
1892										480.	119,638.64	† 115,996.55½
1893	13,376.04	7 47	100,960 99	1,605.95	8 53	10,491 75	14,981.99	7 44	111,455 74	360.	133,014.68	102,590 51½
Totals	144,616.03	$4 16	$602,592 28	11,062.72	$4 87	$53,915 48	155,688.75	$4 22	656,837 76	$21,428.12		

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* This amount is 347.32 less than it should be; as to which see p. 19 of report for 1889.

† This amount is 300.055 more than accords with the report of 1891; as to which see p. 15 of this volume.

TABLE NO. 11.—*Agricultural College lands, United States grant of 1862: Record of forfeitures by counties during the fiscal year ending June 30, 1893, and of the number of acres vacant at the beginning and end of the year.*

Counties.	Acres vacant June 30, 1892, as reported by the land office.	Acres reverti'g by forfeit're during the fiscal year ending June 30, 1893.	Sales during 1893.	Acres vacant June 30, 1893, if columns 1, 2 and 3 are correct.	Acres vacant June 30, 1893, as reported by the land office.	Discrepancy between columns 4 and 5.		Discrepancy noted on page 19 of the agricultural report of 1889.		Total net discrepancy from reports of land office prior to 1879.	
						Shortage.	Excess.	Shortage.	Excess.	Shortage.	Excess.
Alcona	19,967.86		1,402.15	18,565.71	18,525.71	40.		227.92		40.	
Alpena	1,000.	80.		1,080.00	1,000.00	80.					
Antrim	2,440.93	80.	80.00	2,429.93	2,493.00		44.93				
Benzie	4,480.		1,120.00	3,360.00	3,360.00			80.			
Charlevoix	2,839.54	80.	760.00	2,159.54	2,149.54	10.					
Cheboygan	5,091.10		40.00	5,041.10	5,085.96		44.96				
Grand Traverse	160.			160.00	160.00						
Iosco	26,531.32		209.05	26,322.27	26,322 27						
Kalkaska	1,480.68		282.68	1,198.00	1,158.00	40.		40.		120.	
Manistee	5,720.23		400.00	5,320.23	5,277.25		432.				2.99½
Missaukee	879.64			879.64	879.64						
Montmorenci	7,525.20		995.70	6,529.50	6,489.50	40.		40.		40.	
Oscoda	14,055.14	80.	764.92	13,370.22	13,370.32				80.60		83.28
Otsego	2,494.73		1,331.59	1,163.14	1,163.14						
Presque Isle	426.46			426.46	400.00	26.46					106.46
Wexford	20,903.72	40.	7,595.90	13,347.82	13,167.82	180.00		40.		40.	
Totals	115,996.55½	360.	14,981.99	101,372.86	100,909.58	416.46	133.14	427.92	80.60	240.	192.73½

TABLE NO. 12.—*Agricultural College trust fund.*

Year.	Receipts of State Land Office on account of principal for Agricultural College lands sold.	Refunded on account of erroneous payments.	Balance transferred to credit of Agricultural College trust fund.	Aggregate to credit of Agricultural College trust fund at close of each fiscal year.
1868	$2,300 00		$2,300 00	$2,300 00
1869	11,865 00		11,865 00	14,165 00
1870	5,895 00		5,895 00	20,060 00
1871	20,101 53		20,101 53	40,161 53
1872	33,621 93	$174 54	33,447 39	73,608 92
1873	29,583 47		29,583 47	103,109 39
1874	4,686 75		4,686 75	107,879 14
1875	5,399 24		5,399 24	113,278 38
1876	5,939 30	390 00	5,549 30	118,827 68
1877	2,337 22		2,337 22	121,164 90
1878	9,619 99		9,619 99	130,784 89
1879	8,590 53		8,590 53	139,375 42
1880	13,762 28		13,762 28	153,137 70
1881	20,341 18	60 00	20,281 18	173,418 88
1882	51,449 27		51,449 27	224,868 15
1883	34,482 28	825 90	33,656 38	258,524 53
1884	13,802 87		13,802 87	272,327 40
1885	12,460 87		12,460 87	284,788 27
1886	16,545 31		16,545 31	301,333 58
1887	26,731 62		26,731 62	328,065 20
1888	18,122 35		18,122 35	346,187 55
1889	11,431 65		11,431 65	357,619 20
1890	15,991 64		15,991 64	373,610 84
1891	21,994 89		21,992 89	395,605 73
1892	5,808 90	180 00	5,628 90	401,234 63
1893	120,468 27		120,468 27	521,702 90

NOTE.—Fifteen thousand dollars of the above fund was invested from 1870 to 1871 in war bounty bonds and held by the College.

TABLE NO. 13.—*Agricultural College interest fund.*

Year.	Interest on Agricultural College fund, at 7 per cent, paid by State Treasurer from specific tax fund.	Interest from purchasers on balances due on certificates for part-paid land, less refundings and expenses for appraisals, etc.†	Receipts for penalty.	Trespass Collections.	Total accrued to credit of Agricultural College each year.	Amount paid over to treasurer of Agricultural college.	Balance remaining to credit of Agricultural College interest fund at close of each fiscal year.
1869		$56 68	$2 28		$58 96		$58 96
1870	* $874 95	1,789 56	56 42		2,720 93	$2,779 89	
1871	§ 1,397 97	2,317 24	70 63		3,785 84	2,976 00	809 84
1872	3,953 17	3,099 51	122 97		7,175 65	6,774 47	1,211 02
1873	6,040 33	4,907 77	110 96		11,059 06	12,238 48	31 60
1874	7,407 65	6,499 21	155 12		14,061 98	11,896 00	2,197 58
1875	7,717 24	6,552 93	125 97	$50 00	14,446 14	14,656 00	1,987 72
1876	8,124 31	6,692 47	306 64	1,706 75	16,830 17	18,817 89	
1877	8,396 64	5,726 58	189 64	860 00	15,172 86	15,172 86	
1878	8,740 62	6,405 26	247 21	414 00	15,807 09	13,320 61	2,486 48
1879	9,409 73	6,664 80	276 55	627 14	16,978 22	16,602 02	2,862 68
1880	10,240 28	7,333 23	148 73	115 00	17,837 24	17,799 15	2,900 77
1881	11,426 93	8,642 08	285 47	580 77	20,935 25	20,451 85	3,384 17
1882	13,957 04	8,345 45	204 96		22,507 45	25,891 62	
1883	16,741 38	9,141 30	206 96	4,659 96	30,749 60	26,139 13	4,610 47
1884	18,739 02	8,881 98	237 56	51 16	27,909 72	27,402 94	5,117 25
1885	19,645 33	9,121 14	329 06	674 87	29,770 40	29,599 97	5,287 68
1886	20,571 65	9,323 98	565 41		30,461 04	29,920 68	5,828 04
‡1887	16,493 98	7,577 57	309 84	229 98	24,611 37	19,761 06	10,678 35
1888	23,425 64	7,310 84	394 85	1,275 27	32,406 60	32,006 10	11,078 85
1889	24,551 32	6,326 39	320 23	124 75	31,322 69	31,888 12	10,513 42
1890	25,653 31	6,490 27	387 25	20 00	32,360 64	32,228 79	10,645 27
1891	27,197 89	6,690 99	348 22	513 44	34,750 54	26,516 92	18,878 89
1892	27,892 14	6,639 20	316 78	100 00	34,948 12	26,153 78	27,673 23
1893	31,464 01	6,535 69	40 00		38,039 70	51,600 34	13,999 93

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* This amount was interest on war bounty bonds in which the fund was invested at the time.

§ $525 of this was interest on war bounty bonds in which the fund was invested part of the year.

† Appraisal expenses amounted to $1,553.47, ranging from nothing in 1872 to $208.94 in 1886. Advertising amounted to $1,107.84, ranging from nothing in 1870 to $218.35 in 1884. Trespass examination amounted to $4.00 in 1883.

‡ Nine months.

SUMMARY OF INVENTORY, JUNE 30, 1893.

College farm and park, 676 acres @ $70		$47,320 00
Buldings—		
Library and museum, built 1881	$25,000 00	
College hall, “ 1856	20,000 00	
Williams “ “ 1869	40,000 00	
Wells “ “ 1877	25,000 00	
Abbot “ “ 1888	13,000 00	
Chemical laboratory, “ 1871, south end added ’81	18,000 00	
Mechanical “ “ 1885, south end added ’87	10,800 00	
Veterinary “ “ 1885	5,400 00	
Horticultural “ “ 1888	6,000 00	
Agricultural “ “ 1889	7,700 00	
Botanical “ “ 1892 (incomplete)	2,280 30	
Armory, “ 1885	6,000 00	
Greenhouse and stable, “ 1873, 1879; rebuilding ’92	6,331 55	
Greenhouse, experiment, “ 1889	1,500 00	
Boiler house and chimney 1883–4	5,000 00	
President’s and two frame dwellings, built 1874	15,000 00	
Four brick dwellings, built 1857	12,500 00	
Station apartment dwellings, built 1892	3,475 00	
Two brick “ “ 1879 and 1884	6,500 00	
One frame dwelling, “ 1885	4,000 00	
Howard terrace “ “ 1888	14,500 00	
Farm house “ “ 1869	3,500 00	
Herdsman’s “ “ 1867	400 00	
Ten barns at professor’s houses	2,500 00	
Horticultural barn and shed, “ 1868, 1875, 1887	1,500 00	
Cattle barn and shed, “ 1862	3,500 00	
Sheep “ “ 1865	2,000 00	
Horse “ “ 1871	2,500 00	
Pig “ “ 1871	2,000 00	
Corn “ “ 1878	500 00	
Grain “ “ 1881	1,600 00	
Tool “ “ 1881	1,300 00	
Feed “ “ 1884	1,200 00	
Brick work shop, “ 1857	600 00	
Observatory, “ 1880	150 00	
Bath house and fittings, “ 1889	600 00	
Ice house, 1879, $100.00; feed mill, 1889. $100.00	200 00	
Bee houses, 1874, $50.00; 1887, $600.00	650 00—	272,687 17
Iron bridge over Cedar river, built 1888		1,000 00
Water works and steam works—		
Artesian well and connections, sunk in 1887, 343 ft. deep	$1,000 00	
Fire pump, 1883, $600.00; tank pump, 1881, $200.00	800 00	
700 feet fire hose, 2½ in., bought 1883-88	350 00	
Two hose carts and 4 nozzles, bought 1883-88	75 00	
2,378 ft. wood pipe, 6 in., laid 1883-87	1,000 00	
2,623 “ “ “ 4 “ “ 1883-87	800 00	
662 “ “ “ 3 “ “ 1883-87	150 00	
Water tank and heater, built 1883	500 00	
13 fire hydrants in place, built 1883-87	500 00	
Valves, fittings and connections, laid 1883-87	750 00	
Four boilers, 4 ft. x 12 ft., built 1881	1,300 00	
Two boilers, 5 ft. x 12 ft., built 1887	1,400 00	
Two small pumps, 1884-91	320 00	
Underground steam piping, laid 1882	1,700 00	
Miscellaneous tools and stock	1,063 40	
Ten dozen tackle fire escapes	100 00	
Ten fire extinguishers	300 00	
Fuel on hand	150 00	
One water purifier	440 00	
Water meter	25 00	
Injector	22 00	
Main steam pipe, 1892	160 00—	12,805 40
Carried forward		$333,812 57

INVENTORY—*Continued.*

Brought forward		$333,812 57
Farm department—		
Cattles, 42 head	$3,410 00	
Horses, 6 "	1,125 00	
Sheep, 80 "	815 00	
Swine, 11 "	105 00	
Class room, office and farm house equipment	2,275 84	
Tools, implements, scales, windmills, etc.	4,356 49	
Accounts, $180.00; experiment station, $2,028.40	2,208 40	
Growing crop, estimated	2,189 00	
Horticultural department—		16,484 73
Teams, harness, etc.	$545 25	
Heavy tools	484 20	
Compost and manure	150 00	
Small tools	80 95	
Student's tools	304 40	
Office	213 00	
Class room	729 00	
Vegetable garden	177 50	
Greenhouse plants	3,226 30	
Miscellaneous	371 75	
Experiment station	900 07	
Mechanical department—		7,182 42
Class room and office equipment	$3,338 56	
Machine shop	9,607 69	
Wood "	2,250 48	
Blacksmith "	500 49	
Chemical department—		15,697 22
Furniture, apparatus and chemicals	$9,169 11	
Experiment station	1,930 75	
Physical department—		11,099 86
Light	$1,578 29	
Electricity	3,130 55	
Sound	290 10	
Mechanics and fixtures	1,915 44	
Botanical department—		6,914 38
Herbarium	$2,707 00	
Museum	327 00	
Office and class apparatus	2,111 06	
Experiment station	501 19	
Mathematical and engineering department—		5,646 25
Surveying instruments	$1,504 25	
Telescope and accessories	846 75	
Furniture, apparatus, etc.	913 10	
Photographic material	67 90	
Library, inclusive of experiment station library—		3,332 00
16,302 books and 3, 614 pamphlets	$33,813 75	
Furniture	1,954 48	
		35,768 23
Veterinary laboratory—Museum, furniture and apparatus		2,978 75
Zoölogical department—Furniture and apparatus		2,681 91
General museum—Collections and cases		15,653 00
Apiary, bees, stock, etc., including experiment station items		1,000 00
College hall furniture and English department		1,049 62
Drawing		660 53
Photographic apparatus and material		405 67
Public parlor furniture, $191.86; hospital furniture, $20.75		212 61
Club Boarding Association, 15 shares stock		300 00
President's office		800 08
Secretary's office		1,150 00
Weather service		1,994 75
Armory, furniture and equipment		687 25
		$465,421 83

U. S. property held in trust:		
Two 3 in. rifled guns and equipments	$1,573 55	
150 Springfield rifles, complete	2,250 00	
150 rifle equipments	399 00	
Reloading tools, chests, tarpaulins, etc.	183 69	
		$4,396 24

SUMMARY OF EXPERIMENT STATION INVENTORY.

Included in the above total of $465,421.83 is $20,216.52 which belongs to the experiment station consisting of the following items:

Lands donated to the station—		
80 acres at Grayling, fenced and improved	$1,850 00	
5 acres at South Haven, fenced and improved	500 00	
		$2,350 00
Buildings—		
Experiment feed barn	$1,200 00	
Horticultural laboratory, experimental rooms	1,200 00	
Veterinary laboratory, experimental rooms	250 00	
Apiary	600 00	
Forcing house	1,500 00	
Feed mill	100 00	
Sub-faculty building	3,500 00	
Seed room (partially built)	725 00	
		9.175 00
Library and offices of director and secretary—		
1,057 books	$2,165 00	
Files, cards, cases, etc.	114 00	
Furniture, etc.	75 00	
One mailing list in type	246 08	
		2,600 08
Farm department—		
Twelve head cattle	$945 00	
Twenty-eight sheep	75 00	
Office equipment	376 00	
Tools	466 40	
		1,862 40
Horticultural department—		
One horse	$100 00	
Office, furniture, implements, etc.	800 07	
		900 07
Chemical department—		
Thermometers, $154.20; balances, $550.45; platinum, $250.85; sundry apparatus, $975.35		1,930 75
Botanical department—		
Microscopes and accessories	$312 50	
Furniture and sundry apparatus	186 69	
		499 19
Veterinary department—		
Instruments and sundry apparatus		725 00
Zoölogical department—		
Microscopes, cases, etc.		574 10
Apiary—		
Bees, stock and tools		500 00
		$20,216 52

TABLE No. 16.—*Detailed statement of legislative appropriations to the State Agricultural College.*

Object.	Total.	1891.	1889.	1887.	1885.	1883.	1881.	1879.	1877.	1875.	1873.	1871.	1855 69.
Buildings	$221,125 00	Botanical lab'ty $10,000 Heating apparatus 1,950 Greenhouse 4,500 $16,450 00	Agricultural labt'y $8,000 Sundry 1,800 $9,800 00	Howard terrace $10,000 Abbot hall 10,000 Horticultural labt'y 5,000 Mechanical labt'y 3,000 Bridge, etc. 2,100 $30,100 00	Mechanical labt'y $7,800 Veterinary labt'y 5,400 Armory 5,000 One dwelling 4,000 $22,200 00	Boiler house $5,000 One dwelling 3,000 $8,000 00	Library $25,000 Chemical labt'y add. 6,000 Barns 2,775 $33,775 00	Botanical labt'y $6,000 One dwelling 3,000 $9,000 00	Wells hall $25,000 $25,000 00	Bridge $800 $800 00	Greenhouse $8,000 Three dwellings 18,000 $26,000 00	Chemical labt'y $10,000 $10,000 00	Williams hall, 1869 $30,000 $30,000 00
General account	466,211 48					16,770 00	14,498 00	9,943 60	12,300 00	15,276 00	34,796 00	40,000 00	322,627 88
Repairs	39,938 60	7,800 00	5,000 00	1,400 00	3,147 00	6,720 00	1,576 00	1,290 00	3,691 60	5,500 00	3,764 00		
Library	23,055 00	2,000 00	3,000 00	3,000 00	3,300 00	3,125 00	3,000 00	2,000 00	1,190 00	1,000 00	1,440 00		
Farm	26,175 64	2,100 00	800 00	2,815 00	4,810 00	3,389 00	4,175 00	4,016 64	2,400 00	1,670 00			
Garden	11,841 00	570 00	500 00	1,250 00	432 00	1,342 00	3,220 00	2,810 00	947 00	720 00			
Greenhouse	2,765 00	530 00	600 00	340 00	1,295 00								
Botany	5,331 00	500 00	1,000 00	800 00	800 00	2,231 00							
Chemistry	13,955 00	500 00	1,500 00	2,000 00	2,500 00	1,000 00	3,000 00	1,000 00	1,380 00	1,075 00			
Zoölogy	10,071 00	700 00	1,500 00	1,500 00	1,500 00	1,945 00	1,000 00	800 00	480 00	646 00			
Veterinary	2,586 00	100 00	200 00	200 00	2,086 00								
Mathematics	5,590 00	200 00	475 00	600 00	450 00	700 00	2,020 00	1,020 00	125 00				
Mechanical	15,200 00	1,500 00	3,200 00	4,000 00	5,200 00	1,000 00	300 00						
Steam and water	20,832 00	2,045 00	2,920 00	7,500 00	1,400 00	4,267 00				2,700 00			
Institutes	5,800 00	1,500 00	800 00	600 00	600 00	600 00	600 00	600 00	500 00				
Student labor	32,000 00	8,000 00	8,000 00	8,000 00	8,000 00								
Weather service	16,937 50		8,350 00	8,587 50									
Sundry	5,560 00	1,400 00	500 00	2,100 00				600 00	660 00	300 00			
Totals	$294,974 22	$15,895 00	$48,145 00	$74,792 50	$57,720 00	$51,089 00	$67,164 00	$33,080 24	$48,673 60	$29,787 00	$66,000 00	$50,000 00	$352,627 88
Annual tax on each $1,000 of assessment	†$.05½	$.02	$.02½	$.04	$.03⅓	$.03 1-7	$.04 1-7	$.02⅝	$.04	$0.2½	$.05¼	$.01	$.09
* Aggregate tax to date on each $1,000 of assessment	$2.00	$2.0036	$1.963	$1.912	$1.833	$1.7657	$1.7026	$1.6197	$1.5672	$1.49	$1.4407	$1.3359	$1.2565
Assessed valuation of State in millions of dollars		1,130	945.45	945.45	810	810	810	630	630	630	630	630	137 to 308

Counting only taxes actually levied and omitting land grants. † Average.

TABLE NO. 17.—*Income of the State Agricultural College from all outside sources from the date of its foundation to the present time.*

Year.	From State legislature.			From U. S. congress.			Total.
	For current expenses.	For special purposes.	Land sales, salt spring and swamp land grants.	Morrill act of 1862, interest from land grant.	Hatch act of 1887, experiment station.	Morrill act of 1890, supplementary endowment.	
1855			$56,320 00				$56,320 00
1856							
1857	$40,000 00						40,000 00
1858							
1859	37,500 00						37,500 00
1860							
1861	6,500 00		152 25				6,652 25
1862	10,000 00		218 97				10,218 97
1863	9,000 00		407 80				9,407 80
1864	9,000 00		726 09				9,726 09
1865	15,000 00		1,156 61				16,156 61
1866	15,000 00		1,094 27				16,094 27
1867	20,000 00		7,608 38				27,608 38
1868	20,000 00		592 49				20,592 49
1869	20,000 00	$30,000 00	17,559 00	$58 96			67,617 96
1870	20,000 00		1,320 02	2,720 93			24,040 95
1871	18,250 00	10,500 00	4,135 72	3,785 84			36,671 56
1872	18,250 00	3,000 00	217 05	7,175 65			28,642 70
1873	21,796 00	15,602 00	10 13	11,059 06			48,467 19
1874	13,000 00	15,602 00	150 13	14,061 98			42,814 11
1875	7,638 00	7,755 50	144 53	14,446 14			29,984 17
1876	7,638 00	6,755 50	1,773 09	16,830 17			32,996 76
1877	6,150 00	30,686 80	979 06	15,172 86			52,988 72
1878	6,150 00	5,686 80	826 60	15,807 09			28,470 49
1879	4,971 80	16,068 32	712 22	16,978 22			38,730 56
1880	4,971 80	7,068 32	797 55	17,837 24			30,674 91
1881	7,249 00	43,720 50	461 95	20,935 25			72,366 70
1882	7,249 00	8,945 50	358 46	22,507 45			39,060 41
1883	8,385 00	23,793 00	391 95	30,749 60			63,319 55
1884	8,385 00	10,526 00	1,259 90	27,909 72			48,080 62
1885		35,103 00	187 50	29,770 40			65,060 90
1886		22,617 00		30,461 04			53,078 04
1887		* 44,040 00	† 198 20	† 24,611 37			68,849 57
1888		30,752 50	444 20	32,406 60	$15,000 00		78,603 30
1889		* 20,973 00	10 50	31,322 69	15,000 00		67,306 19
1890		* 27,172 00	238 50	32,360 64	15,000 00	§ $15,000 00	89,771 14
1891		22,947 50	37 38	34,750 54	15,000 00	16,000 00	88,735 42
1892		22,947 50	137 38	34,948 12	15,000 00	17,000 00	90,033 00
1893		16,862 50		38,039 70	15,000 00	18,000 00	87,902 20
Totals	$362,083 60	$479,125 24	$100,627 88	$526,707 26	$90,000 00	$64,000 00	$1,624,543 98

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* Including appropriations for weather service.

† Oct. 1, 1886, to June 30, 1887, nine months.

§ Received Nov. 15, 1890.

A SUMMARY OF THE RESOURCES OF THE STATE AGRICULTURAL COLLEGE.

Farm, buildings and equipments, as per inventory on pp. 17–18	$165,421 83
Agricultural College trust fund, from sale of lands of United States grant	521,702 90
Balance due on purchase money " " " " " " "	85,219 73
102,590 acres @ $5 per acre as yet unsold " " " " "	512,950 00
320 acres @ $5 per acre yet unsold of swamp land grant	1,600 00
Total	$1,586,894 46

The 115,996.55½ acres yet vacant of the U. S. land grant are given in detail as located in the different counties in table No. 11, p. 15.

The 320 acres of swamp land is what still remains unsold of a grant from the State to the College of swamp lands located in the township of Bath, in Clinton county.

The present amount of the trust fund is taken from the last line (that for 1893) of the fifth column of table No. 12, p. 16.

The balance due on purchase money is reported by the Commissioner of the State Land Office, and consists of the total amount for which the college lands have been sold up to the present time, *i. e.:*

The total of the fourth column from the right in table No. 10, p. 14	$656,837 76
Less the payments made on these sales, constituting the trust fund	521,702 90
	$135,134 86
And less balances unpaid on abandoned descriptions which have reverted to the State by forfeiture for non-payment of interest, as shown in the third column from the right, in table No. 10, page 14	49,915 13
	$85,219 73

DEPARTMENT REPORTS.

REPORT OF THE PRESIDENT.

The enrollment of students for the year was 355. The following table gives the enrollment by classes and sexes:

SUMMARY OF STUDENTS.

	Agricultural.	Mechanical.	Special.	Ladies.	Total.
Post-Graduates	16		13	6	35
Seniors	34	12		6	52
Juniors	24	23			47
Sophomores	39	28		2	69
Freshmen	55	56		5	116
Specials		1	29	6	36
Total	168	120	42	25	355

Of these students 193, including ladies, were in the agricultural course; 114 in the mechanical course, and 42 in special courses.

Our annual commencement occurred August 18, 1893, when 44 students were graduated with the degree of bachelor of science. Their names are as follows:

Names in italics denote Students in the Mechanical Course.

NAME.	POSTOFFICE.	COUNTY.
Bain, Benjamin F.	Petoskey	Emmet.
Baker, Luther H.	Lansing	Ingham.
Benjamin, George W.	Cedar Run	Grand Traverse.
Blake, Sherman J.	Galesburg	Kalamazoo.
Briggs, Lyman J.	Lacey	Barry.
Bristol, Roy C.	Almont	Lapeer.
Burnham, Alton C.	Russell	Isabella.
Champion, Miss Daisy	Lansing	Ingham.
Chapin, Claudius B.	Schoolcraft	Kalamazoo.
Chase, Albert B.	Bangor	Van Buren.
Clark, Fred P.,	Schoolcraft	Kalamazoo.
Clute, Miss Lucy M.	Agricultural College	Ingham.
Cole, Dwight	Meridian	Ingham.
Cook, Albert B.	Agricultural College	Ingham.
Cook, Miss Katharine E.	Agricultural College	Ingham.
Cowley, Miss Jennie M.	Lansing	Ingham.
Crosby, Dick J.	Elbridge	Oceana.
Cumings, Willard L.	Grand Rapids	Kent.
Dimmick, John Bagley	East Tawas	Iosco.
Goss, Harry M.	Plainwell	Allegan.
Hale, Elmer B.	Orleans	Ionia.
Hall, Oscar B.	Greenville	Montcalm.
Harvey, William L.	St. Croix Falls	WISCONSIN.
Hedrick, Ulysses P.	Harbor Springs	Emmet.
Holmes, Clarence E.	Lansing	Ingham.
Maxfield, Warren A.	Coopersville	Ottawa.
McElroy, Edward M.	Schoolcraft	Kalamazoo.
Paddock, Wendell W.	Three Oaks	Berrien.
Pagelson, Otto H.	Grand Haven	Ottawa.
Palmer, Herbert F.	Napoleon	Jackson.
Parker, William W.	Charlotte	Eaton.
Perrien, Joseph	Detroit	Wayne.
Peters, Edwin C.	Saginaw, E. S.	Saginaw.
Pickett, Robert B.	Albion	Calhoun.
Porter, Frank J.	Leland	Leelanaw.
Potter, John L.	Grand Rapids	Kent.
Smith, Emile	Detroit	Wayne.
Smith, William G.	Howell	Livingston.
Stevens, Alva T.	Mason	Ingham.
Steward, Valmore L.	Agricultural College	Ingham.
Thayer, E. Noyes	Grand Rapids	Kent.
Tracy, William W.	Detroit	Wayne.
Watkins, L. Whitney	Manchester	Washtenaw.
Wheeler, Miss Lillian	Agricultural College	Ingham.
Wight, Justin T.	Allegan	Allegan.
Willey, Vernon J.	Pewamo	Ionia.

Total 41

At the same date the degree of M. S. was conferred on the following graduate students who had complied with the condition of one year's residence at the college and study under the direction of professors:

Edwin DeBar, of Oklahoma.
G. C. Lawrence, Agricultural College.
J. W. Matthews, Grand Rapids.

On recommendation of the faculty the board conferred the degree of Doctor of Laws on Pres. O. Clute, and Master of Horticulture on Henry G. Reynolds.

Bulletins were published during the year as follows:

92. Small Fruit Notes. Spraying.
93. Potatoes, Amounts of Seed.
94. Birds of Michigan.
95. Potatoes.
96. Honey Analyses.
97. Fertilizer Analyses.
98. Locusts—The Horn Fly.
99. Michigan Soils.
100. Eighty New Strawberries.

The bulletins have had a circulation of about 7,000 copies each when issued from month to month. They are all republished in the annual report of the State board of agriculture.

The experiment station is controlled by the State board of agriculture. The list of station officers and workers is given on page 5.

Permit me to ask attention to the full reports from the heads of departments in the college and the experiment station, which will be found in the board report; and also to the report of the secretary, which gives full and explicit statements of receipts and expenditures, of the sources of income, and of the college lands, and also a complete inventory of all buildings, furniture, aparatus, stock, implements, etc., belonging to the college.

Very respectfully,
O. CLUTE,*
Pres. Mich. Agr'l College.

AGRICULTURAL COLLEGE P. O.
August 20, 1893.

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* Pres. Clute resigned to take effect August 20, 1893.

REPORT OF THE PROFESSOR OF AGRICULTURE AND SUPERINTENDENT OF THE FARM.

To the President:

Class instruction has been given the past year in the agricultural department as follows: In the spring term the sophomores were given a six weeks course of lectures by Mr. P. G. Holden upon soils, crops, rotation drainage, etc. The freshmen were given a full term instruction by Prof. Burnett and myself upon breeds of live stock. Stock breeding and stock feeding were taught the juniors by Mr. Mumford. The seniors were given a course of lectures upon dairying and other specialties in farming by myself. Instruction in pedigree work has also been given as heretofore. The policy outlined in my last report as regards student labor has been followed out so far as possible, and in the main I believe with satisfactory results.

The improvements in the college farm have been continued so far as means would allow. Much gravel has been placed upon the lane and some draining has been done in No. 11. A very great improvement has been made in the barn yards; a fine double fence has been built to accommodate bulls and other farm animals, and the silo has been newly lined and greatly improved. Some three hundred cords of wood were cut during the winter and nearly five hundred cords of old wood were hauled to the brick yards. In January, 1893, the farm foreman, Mr. Joseph McCracken, died of diphtheria. The board soon afterwards hired Mr. Ernest Wittstock, who has continued as foreman since that time. The board purchased a pair of young horses for the department and an old pair were disposed of. A McCormick reaper has been purchased and the following implements have been loaned to the department: One De Laval cream separator by the De Laval Separator Co., of New York; a No. 2 creamery, cream ripener, churn, butter worker and set of butter jars, by the Crystal Creamery Co., of Lansing; a Champion milk cooler, from the Champion Milk Cooler Co., Courtlandt, N. Y.; one rotary disc cultivator, W. L. Marshall, Chicago, Ill.; one reversible plow and set of cultivator teeth for deep and shallow cultivation, by Gale Manufacturing Co., Albion, Mich. We are also under obligations to Messrs. Stone, Atwood & Co., of Flint, for favors in scouring of wool, etc., and to various herd book associations for gifts in their line. This department has been called upon during the year to prepare the State exhibit, as well as to furnish the material and prepare for one-fourth of the space in the State exhibit, Agricultural building, at the World's Fair, in Chicago. This entailed a vast amount of detail labor and was well done by Mr. Mumford and students. Mr. Mumford also went to Chicago and set up the exhibit.

During the past year we have reduced the number of Shorthorns, and have purchased one specimen of Aberdeen Angus, four of Gurnseys and two of Brown Swiss, all females. We have also had given to us one Brown Swiss bull from Hon. E. M. Barton, Hinsdale, Ill., of whom we purchased the Brown Swiss heifers. It has been the policy of the department to increase the numbers of breeds represented rather than to increase the individuals in each breed, consequently only the best representatives in each breed have been kept, others have been sold. The primary object of keeping stock on the college farm should be, it seems to me, for purposes of student instruction. This accomplished, the best possible use from a business standpoint is afterwards made of them. Our cattle in the main have done well. This is especially true of the milch cows, one having given as high as 81 pounds of milk in a single day, and one testing 19 lbs. 8 oz. of butter in a single week. Several of the Holstein Fresians have been accepted for advanced registry.

The sheep have thrived during the year, especially the lambs in the early part of the season. We have been less fortunate with our swine, having lost several animals during the year. They are apparently quite healthy now.

During the winter I attended and lectured before farmers institutes at Lowell, Cass City, Bad Axe, Carsonville and Memphis, and farmers meetings at North Lansing and Bath, and my assistants did their full share of institute work. I also attended the meeting of American Association of Agricultural and Mechanical Colleges held at New Orleans November, 1892, before which association I read a paper upon, "What Shall the Professor of Agriculture Teach?" It was my province also to visit the following stations during the year, namely: Wisconsin, Illinois, Mississippi and Louisiana. The three latter stations were visited during my trip to New Orleans. I deem these visits especially valuable, as it furnishes the best means of acquainting oneself with the labors of co-workers in agricultural lines. The department received from Mr. L. B. Townsend, of Ionia, a very fine collection of samples of wool, of Rambouillet Merino.

The retirement of Messrs. Holden and Burnett left the department short-handed toward the close of the year. My own resignation, sent in the early spring, though not yet accepted, renders this probably my last annual report. On retiring from the department I desire to express my thanks for the many words of encouragement and commendation which I have received from many friends here. I wish for my successor* his full share of prosperity in his work.

Very truly yours,
P. M. HARWOOD,
Professor of Agriculture.

AGRICULTURAL COLLEGE,
June 30, 1893.

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* Prof. Harwood resigned to take effect August 20, 1893.

REPORT OF HORTICULTURAL DEPARTMENT.

To the President:

SIR—I submit herewith the report of the Horticultural Department for the past twelve months.

The instruction given in this department has been along the same lines as in former years. The seniors who elected the subject took up in the spring term the construction of greenhouses, and the methods of growing some of the more important crops that are forced under glass, such as lettuce, roses, carnations, violets, etc. They devoted some time also to the study of some of the more troublesome diseases of the apple, pear, plum, peach, cherry, raspberry, strawberry, tomato, bean, rose, carnation and other plants of economic importance. They also prepared all of the leading insecticides and fungicides, and made drawings, of the various fungi studied, for exhibition at the Columbian Exhibition.

The brief time allowed for the juniors to complete their class-room instruction in horticulture (ten weeks in advance work), has again been altogether too short. An attempt was made, however, to consider the subjects of pomology and vegetable growing, and some attention was paid to the improvement of varieties, the propagation of plants by the various methods, transplanting, pruning, training and, in a general way, the preparation and application of the remedies for the various fungi and insect pests. As a part of the afternoon laboratory work, they were given practical instruction in the various methods of grafting, the making of cuttings and sundry other lines of nursery and greenhouse work.

During the season of growth each student was placed in charge of some crop, or was given some experiment to care for, and he was expected to perform all of the work of planting, tending and harvesting, besides keeping the necessary notes of his work, and destroying the insects and fungi that might attack it. In addition to this special work that each student was supposed to carry on, an endeavor was made to give each of them an insight into other lines of work, by assigning them to work with other students when their own work did not need attention. During the summer and fall terms considerable time was spent in studying the characteristics of many of the leading varieties of fruits and vegetables.

The sophomores were given instruction in landscape gardening during the first half of the fall term. Here again the time was found altogether too short, as it was not only lessened one week by changes in the catalogue, but it was still further shortened by the giving up of one week of the term for visiting the Columbian Exposition, so that the real time for advance work was but little more than four weeks.

THE EXHIBIT AT THE WORLD'S FAIR.

The department occupied a space of about 100 square feet at the World's Fair, in connection with the other departments of the college in the Liberal Arts building. The exhibit was designed to be educational in its character, and consisted largely of samples of the work of the students, with a small collection of garden and greenhouse hand tools and a few other articles that are used as means of illustration. The students work showed twenty drawings of the more troublesome fungous diseases studied by them, ten illustrating different methods of building growing and forcing houses, and ten others showing the different methods of propagating plants. In each case the enlarged details were shown and the drawings could be readily understood from the copious foot-notes affixed to them. The drawings were eighteen by twenty-four inches and were arranged behind glass, in swinging frames. A variety of methods of propagating plants were also shown, by actual samples of grafts, buds and cuttings, displayed in glass jars in preservative fluids. There was also exhibited a collection of the more valuable insecticides and fungicides, carefully labeled so as to show the ingredients of each, while in smaller bottles, grouped around the others, were the materials in the actual quantities required. A collection of plaster models of potatoes, molded and colored by students was also shown, as well as about one hundred and fifty varieties of garden vegetable seeds, most of which were grown and put up by the students. Bound volumes of the examination papers of the three upper classes, were also shown.

To the coöperative exhibit of Agricultural Colleges and Experiment Stations, we also contributed a set of drawings illustrating greenhouse construction, and a set of photographs showing the equipment of the department and the students engaged in various kinds of laboratory and manual labor.

The exhibit which attracted most attention, however, was the collection of wax fruits and vegetables, shown in the Horticultural Hall. It consisted of about eight hundred pieces, and the specimens had so natural an appearance that, although plainly so labeled, many who saw them were with difficulty convinced that they were artificial. They were made by Mrs. Stanley Potter of South Haven, the fruits being modeled from specimens grown upon the sub-station grounds or that were kindly contributed by friends along the "lake shore," while most of the vegetables were sent from the College.

IMPROVEMENTS.

By means of the appropriation of $3,500 made by the last legislature, we were enabled to put down nearly two miles of artificial stone walks, of widths ranging from three to six feet, with an average of about three feet and nine inches. Every important building can now be reached in a fairly direct manner from nearly all points upon the grounds, without leaving the walk. It is hoped that there will be fewer "sheep paths" across the lawns now that we have the stone walks. The work was done by the Cleveland Silex Stone Co., of Detroit, in a painstaking manner, and it is hoped that they will prove durable. The appropriation was not sufficient for constructing all that are needed (the original estimate having been cut down five-hundred dollars by the legislature), although a considerable amount was obtained by the work of the department men and teams, drawing gravel, grading, etc., and it is hoped that the system can be, in the near future, completed.

Among the other improvements may be noted the grading, sodding, planting and the laying out of walks and drives to the new buildings, the rebuilding of the dam in Cedar river to provide a sufficient supply of water for fire purposes, and a quiet pond from which a supply of ice could be obtained, and the construction of a bridge just south of the Wild Garden, the old rustic bridge having become unsafe.

For several years the use of the college drives as a thoroughfare by teams going to and from Lansing, had so increased, and the privilege was so abused, that it became necessary, in order to keep the drives in good condition, to close the north and east gates, and open a new outlet towards the north by means of a drive constructed along the east side of the Arboretum. While affording a means of entering the grounds from that direction, it is sufficiently indirect to keep out teams loaded with stone, wood, hay and straw, that have in the past so worn the drives and littered the lawns.

Among the additions to our office and class room conveniences may be noted a card index of our orchard and ornamental trees, which had become almost a necessity from the extensive planting of recent years in our experimental orchards; a card catalogue, arranged as a subject index to the horticultural periodicals and the reports of horticultural societies, and last but not least the collection of wax fruits and vegetables and the other exhibits made by this department at Chicago, which have been returned and are to be a part of our class room equipment.

During the summer a considerable addition was made to our economic herbarium.

GROUNDS.

The frequent rains of the spring and early summer kept the lawns in excellent condition, but the drought of July and August parched them badly. The shrubbery planted in 1891 and 1892 made an excellent showing the first part of the season, but, although it suffered no permanent injury, its growth was checked from lack of rain. The flowers, also, where they could not be reached by the hydrants, suffered severely during August from the same reason. When not otherwise employed, the teams were engaged in hauling gravel for the drives and in a short time they will be in good condition.

GREENHOUSES.

The plants, under the care of the florist, Mr. Thomas Gunson, have been in excellent condition, and particularly those planted out have made a good growth. A plant of Abyssinian banana, *Musa ensete*, has been particularly striking in appearance, it having a stem over two feet in diameter and leaves nearly twenty feet long, when but eighteen months from seed, with nearly all of the growth made in nine months. The orchids have flowered quite freely and have been much admired. The palms, crotons, dracænas and ferns have also been very attractive, and the houses have been kept bright during the summer months by very good collections of tuberous begonias and fancy-leaved caladiums. The beds of cannas, coleus and geraniums in the lawns near the greenhouse have been kept watered and throughout the season have been very striking in appearance, owing in part to the contrast with the parched lawns around them. While our present greenhouses enable us to secure quite good results, our plant is by no means complete. What is most needed is a small house to be used for propagating purposes, and a vegetable house in which the winter forcing of vegetables can be carried on. We have used the houses of the experiment station for the growing of crops of tomatoes, cucumbers, lettuce, radishes, etc., when not in use for station work, but they were not built for the purpose and, although fair results have been obtained, they can be used to better advantage for other crops.

VEGETABLE GARDEN.

Despite the drought, good crops of nearly all kinds of vegetables were secured. They were grown, gathered and, for the most part, sold upon the grounds by the students, who were thus able to obtain actual practice in vegetable gardening. Were it not for the protests of neighboring farmers who market their surplus vegetables in Lansing, we could engage in the growing of vegetables upon a much larger scale, and would find a ready market for them. If this could be done, we should be able to give a much larger experience in this line of horticulture.

FRUIT GARDENS AND ORCHARDS.

The strawberry crop was excellent in every respect, although, from the fact that our plantation is composed of two hundred varieties, planted for experimental purposes, it did not give as large a yield as would have been obtained had it consisted of but two or three standard commercial sorts. The raspberries and blackberries promised well in the early part of the season, but the crop was cut short by the drought. The currants and gooseberries were loaded to the ground, except in case of a few sorts of the former that were injured by the currant borer. The cherries produced good crops, as did such trees of peach and plum as were of a bearing age. Only a small crop was obtained from the pear trees, while the apple trees were so weakened by the apple scab fungus, by which they were attacked in the spring of 1892, that they could form no fruit buds, and, as a result, the crop of 1893 was very light.

During the year my foreman, Mr. A. G. Gulley, had charge of the work of the men and the team, and of the students in the grafting room and in the nursery and orchards in particular. In October, he accepted an appointment to the Vermont Agricultural College, as professor of horticulture and horticulturist of the experiment station, and left at once for his new field of labor and usefulness.

Mr. H. P. Gladden and Mr. R. J. Coryell, although connected with the Experiment Station, have rendered valuable assistance to the college work of the department by directing the labor of the students and giving instruction in the lines they have under their charge.

OUTSIDE WORK.

In addition to the duties at the college, I spent two weeks in attending the long institutes at Paw Paw and Union City, and another week in similary work at Benzonia, Traverse City and Eastport. Messrs. Gulley, Gladden and Coryell also devoted from two to three weeks each to institute work, so that some one or more from this department were present at every institute held in 1892-3.

I also attended and read papers at the annual meeting of the State

Horticultural Society at Ann Arbor, and the summer meeting at Shelby, and addressed the meetings of several county societies.

During the summer, I made four short visits to the World's Fair, at one time attending the sessions of the Horticultural Congress and the American Pomological Society, and in November was a delegate to the convention of Agricultural Colleges and Experiment Stations.

WANTS OF THE DEPARTMENT.

In addition to the need for additional greenhouses and walks as mentioned above, there is an urgent necessity for books upon horticultural subjects to be placed in the general library, and for the thorough overhauling of the interior of the horse barn. Were a slight increase of means at my disposal, a large return could be secured in the general appearance as well as in the educational value of the grounds, by the continuation of the planting with shrubbery and trees, thus securing both an arboretum and an improved landscape effect.

Respectfully submitted,
L. R. TAFT.

AGRICULTURAL COLLEGE,
November 15, 1893.

*REPORT OF THE MECHANICAL DEPARTMENT.

To the President:

SIR—I have the honor to submit the following report of work done in the Mechanical Department during the past four months.

I assumed charge of the department on the first day of September, 1893.

During the fall term the program of study previously established was carried on as follows:

Seniors.—Valve Gears and Thermodynamics, by Prof. Weil.

Sophomores.—Lectures on Work Shop Methods, by Prof. Chamberlain.

Seniors and Juniors.—Steam Engine and Machine.
Design by Mr. Westcott.

All Classes.—Shop Work by Prof. Chamberlain and Mr. Groesbeck; Mr. Bender in Wood Work and Mr. Theodore in Blacksmith Shop.

Also:—

Seniors.—A short course in Strength of Materials, by Mr. Westcott.

Seniors. A short course in Calibration of Instruments, by Prof. Chamberlain.

Practically no change was made in the duties of the different instructors of the department. Prof. Chamberlain and Mr. Bender carried on the work of Prof. Van Dervoort and Mr. Curtis respectively; the work of Prof. Breckenridge being attempted by myself.

During the fall term the erection of an extension to the mechanical building to provide room for a foundry and a new blacksmith shop was undertaken, and said extension is now completed. A Colliau cupola (24 inches diameter inside of lining) has been purchased and put in place, also in working order. Plans have been prepared for a core oven, and also, to a certain extent provision has been made for placing a crane in the foundry.

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*Prof. Breckenridge of this department resigned and left no report. The printing of the annual report being delayed, a preliminary report of his work for the fall term of 1893 by Prof. Weil, his successor, is inserted in this volume.

Plans have also been prepared for the arrangement of forges in the new blacksmith shop and material for carrying out the arrangements planned is now being assembled.

It is proposed to furnish the blast and to remove the smoke and gasses (in the blacksmith shop) by means of a blower and exhauster respectively and to furnish the power to these by means of an independent engine. The purchase of a Case engine for the last named purpose has been decided upon; this engine presents many points of interest to mechanics in its construction, and will thus serve as a model for use when giving instruction, as well as a power unit.

The piping from the forges to the fans will be laid in "boxed trenches," already constructed, and of a design that renders the piping readily accessible, thus securing in the blacksmith shop unbroken sources of light, and providing for the better supervision of individual forges, by the instructor from any point in the room.

It is proposed to erect at present only those forges now owned by the college—eleven in number—and for the remainder make the necessary castings in the college foundry during the coming term.

In the wood shop the floor has been extended to cover the formerly existing well, and individual benches are now being constructed to replace the continuous bench, ranged along the side of the room, used in the past. In the construction of these benches the material of the old bench is being utilized. When completed this room will have nineteen benches, with room for at least six more; as each bench is arranged to allow two students to work at the same time this arrangement provides for the immediate handling of thirty-eight students, or ultimately fifty students students at one time.

Plans have been prepared for a tool room in the wood shop, and for this room space has been reserved.

An 8x13x12 compound engine, the construction of which began previous to my taking charge of the department has been completed and can be in place in the engine room, before the beginning of the coming term.

Plans have been prepared for changing in the shops certain partitions in order to obtain what it is thought will be a better distribution of floor space. The work of changing these partitions is now being carried on. The plans provide for more floor space in the engine room, in the experimental room, and for a practically separate wash room.

Attention is particularly called to the fact that the alterations made, during this vacation time, and the completion of the compound engine, have been accomplished with the aid, in the main, of student labor.

My class room work commenced on the morning of my arival at the college, and I was necessarily somewhat hampered in my work by unfamiliarity with my surroundings, but as a rule I found the students ready and willing, and my labors were much alleviated by the impetus given to the work in the mechanical course by my predecessor—Prof. L. P. Breckenridge.

Respectfully submitted,
CHAS L. WEIL.

Agricultural College,
Vacation, Dec. 30, 1893.

REPORT OF CHEMICAL DEPARTMENT.

To the President of the Michigan Agricultural College:

The annual report for the chemical department for the year ending June 30, 1893 is herewith submitted. The fiscal year divides the academic year, rendering the report of the departmental work less satisfactory.

The year has been satisfactory both in the attendance and deportment of the students, the earnestness of their class and laboratory work and in the results secured. The results of the effort to combine class work and laboratory practice are such as to justify the wisdom of the plan and to sanction the extension of the laboratory method. In science *to do* is *to know*, and any form of instruction in science which bars the student from contact with nature's forces is doomed to failure. The laboratory method will soon be recognized as the only logical method of instruction.

AGRICULTURAL COURSE.

The sophomore class take elementary chemistry in the summer term, using Bloxam's chemistry as a text book, with lectures and demonstrations in class room, and chemical manipulations and rehearsals of experiments in the laboratory as time will permit. The first term of the junior year is devoted to organic chemistry, with lectures and laboratory practice. They also spend one hour daily for half of the term with blowpipe practice and quantitative analysis by volume. In the spring term the juniors spend two hours a day in quantitative chemical analysis, followed by agricultural chemistry in the summer term.

The studies of the senior year are elective, but a large part of the class take meteorology and quantitative analysis, including assaying.

MECHANICAL COURSE.

The students in the mechanical course spend much less time in chemistry—too little time when the importance of the study to the mechanical engineer is considered.

In the first term of the junior year the class spend seven hours a week in general chemistry, largely in laboratory practice, special attention being given to what may be called the mechanical metals or the metals most largely used by the engineer and machinist. This work is continued in the spring term and special lines of work are taken up, such as analysis of water for use in boilers, boiler scale, analysis of coal (hard and soft), determining the heating power of coal; analysis of gases from the boiler house chimney, etc.

GENERAL WORK.

In addition to class and laboratory work, the chemical department has given attention to work of more general character for the good of the public. The number of special investigations required by the public makes a large demand upon the time of the members of our staff. Questions continually arise demanding immediate investigation and in this way the college justifies its existence by the aid thus rendered to the public. The centennial or Columbian year made large demands for a proper display of Michigan matters for the Chicago Exhibition; the preparation and analysis of representative soils, grains and feeding stuffs, fertilizers, etc., etc.

The proper display of Michigan and her resources was given a place of honor in our work.

FARMERS' INSTITUTES.

For the purpose of visiting Mexico and examining the resources of our sister republic, the senior professor was excused by the State Board of Agriculture from work in the Farmers' Institutes, but the adjunct professor attended four long institutes, viz., at St. Louis, Union City, Paw Paw, and Lowell.

Respectfully submitted,
R. C. KEDZIE,
Professor of Chemistry.
F. S. KEDZIE,
Adjunct Professor of Chemistry.

AGRICULTURAL COLLEGE,
——— ———, *1893.*

DEPARTMENT OF ZOÖLOGY AND ENTOMOLOGY.

To the President:

DEAR SIR—I have the honor to submit my report not only for the fiscal year, but as I am to leave the college I include the present fall term. My classes for the entire time have been unusually large and earnest, enthusiastic, punctual and attentive. I had large classes in the required studies, and more than I could well manage in the elective studies. For the first time geology was a full term study in the spring of the present year. An exceptionally large number elected the study, and the results were quite satisfactory. In the summer term eight students elected advanced zoölogy. And this fall term ten of the sixteen seniors elected zoölogy.

During the winter of 1892–3, I attended and took part in two of the long institutes and three of the short ones. The long institutes were exceedingly interesting.

During the year, though no longer a member of the experiment station, I have prepared two bulletins, one on "Honey Analyses," all the copies of which are distributed, and the second one "The Birds of Michigan." The 8,000 copies of this last were all called for very soon, and a second edition of 3,000 copies was issued. The demand for this is so great that a third edition must be published soon. This has received high praise from the first ornithologists of the United States, and has attracted wide notice abroad.

In closing I wish to express my regret at parting with the faculty, with whom my relations have been so pleasant. I believe that few men are so happy as to be associated for nearly thirty years with men so courteous, so able, and so ready to aid and assist all their colleagues, whenever aid is desired. Since my first appointment, in 1866, I have had none but the most pleasant relations and most courteous treatment from all the faculty. Hardly less keen is my regret at parting with our students. I have with very few exceptions found them earnest, enthusiastic, and always gentlemen. To be associated with such colleagues and such students leaves little to be desired in way of associations.

I leave principally because of the attractions of California, and the fact that my department with the assistants I have had is too large for me to do the work as I desire to do it.

In conclusion I earnestly hope that the department may be divided, and that two professors instead of one may be appointed to do the work that I have been called upon to perform. In the present excellent condition of the department. I am sure that this alone is necessary to make it the peer at least of any similar department in the country.

Thanking you Mr. President and all others here for the aid and kindness which I have received uniformly at your and their hands,

I am very truly,
A. J. COOK.

AGRICULTURAL COLLEGE P. O.,
November 10, 1893.

REPORT OF THE PROFESSOR OF BOTANY AND FORESTRY.

To President Clute:

I present the following as my report for the year closing June 30, 1893.

During the year students have received instruction in botany as follows:

Freshmen in structural botany, twelve weeks	44
Sophomores in systematic botany, six weeks daily	25
Sophomores in systematic botany, one day per week for twelve weeks	25
Sophomores in physiological botany, twelve weeks, daily	29
Seniors in parasitic fungi, twelve weeks, daily	8
Resident graduates for two weeks to two terms, daily	18
	149

THE HERBARIUM.

The growth of the herbarium may be seen by the enumeration of additions made during the last twelve months. The additions are not so large as they were during each of the two preceding years.

The following are the additions for the last twelve months:

J. H. Simpson, from U. S. Dept. of Agr., Florida plants	87
T. Morong, New York, *Naiadaceae*	91
J. K. Small, S. W. Virginia plants	300
M. E. Jones, Utah and Rocky Mountain plants	2,802
H. N. Patterson, Colorado plants	160
B. C. Buffum, Wyoming grasses	98
Dr. H. H. Rusby, Bolivian plants	75

T. F. Cheeseman, New Zealand, grasses	100
O. Gelert, Denmark, grasses	100
J. Macoun, Canada, flowering plants	50
C. G. Pringle, Mexican flowering plants	275
E. R. Lake, Washington, grasses	70
C. K. Dodge, Port Huron, Mich., flowering plants	100
State collection by the college for the World's Fair	721
Varieties of wheat	315
B. D. Halsted, N. J., weeds	100
J. Macoun, Canada, mosses	100
J. Macoun, Canada, lichens	100
C. E. Cummings, Mass., lichens	54
C. L. Shear, *fungi*	100
J. B. Ellis, N. Y., *fungi*	100
A. B. Seymour, Mass., *fungi*	150
L. M. Underwood, Ind., *hepaticæ*	20
Total	6,068

They have nearly all been mounted and placed in the cases and are apparently in fine condition. No insects have been seen in the collection for a long time.

At present the herbarium contains sheets as follows:

Phanerogams	29,919
Lichens	674
Hepaticæ	277
Mosses	798
Algæ	45
Fungi	4,503
	36,216

THE BOTANIC GARDEN.

This has been considerable improved, though owing to the delay in putting the sewer to the river through a portion of the garden, some of the families have not been placed in the positions intended for them. We have purchased seeds and plants, and collected from various portions of the State from time to time, thus adding perhaps not far from five hundred species during the year. Of course, some have perished for one reason and another, such as the unfavorable conditions of soil or moisture, two unusual freshets in June, or a rather severe winter. But few plants were lost in winter, as they were mostly well mulched with marsh hay late in autumn.

The grass garden has been moved to a more convenient place, where it is easily accessible to students and visitors. It is now southeast of Well's Hall, where we have a fine variety of soils, exposure and moisture. At this writing most of them are not making a great display as they are coming from seed sown this spring.

THE ARBORETUM.

These young trees keep growing where most of them was started in 1877, sixteen years ago. Cultivation in all parts has now entirely ceased. Some thinning is done during each year.

THE NEW LABORATORY.

Late last autumn we moved from temporary quarters in the agricultural laboratory to the new building. From spring to autumn, for three long years, botany was without a home, and we were unable to perform very good work on this account. Owing to a lack of money, the equipment was delayed for eight months longer. A full account of the plans was given in the last report of the Board of Agriculture.

THE MICHIGAN FLORA.

This was issued in pamphlet form, in addition to its appearance in my last report printed in the Michigan Board of Agriculture. It has been extensively distributed among botanists, and continues to be in considerable demand by teachers and amateur botanists. The work has received many high compliments, especially for the novel feature of the introductory portion, which shows the economic side of botany.

REPORT OF THE PROFESSOR OF VETERINARY SCIENCE.

To the President of the Michigan Agricultural College:

SIR—I herewith beg to submit a report of the work done in the veterinary department during the year 1892–3.

A new class began the study with the autumn term of 1892, being composed of twenty-three seniors from the agricultural course and one post graduate, the latter, however, had to withdraw from the class soon after its organization, having accepted a responsible position in a business capacity at some distance from the college.

The instruction given during this term was devoted, as on previous occasions, to the anatomy of such domestic animals as the horse, ox, sheep and hog, in which the class seemed to take unusual interest, probably to be partly accounted for by the fact that the students had in anticipation the preparation of an anotomical exhibit for the Columbian Exposition at Chicago.

At the close of the term we dissected two horses, which served as a practical review of our class room work up to this point. We also began the preparation of a skeleton to be afterwards shown with our collection at Chicago.

At the annual convention of the Association of American Agricultural Colleges and Experiment Stations, I was elected to take charge of the veterinary alcove in the college and station space at the World's Fair, and on the 1st of December, 1892, I received a commission from the representative of the Department of Agriculture at Washington, directing me to report for duty as special agent, and upon receiving instructions from the State

Board of Agriculture to do so, I proceeded with the work. I at once placed myself in communication with the twenty-six veterinarians who had charge of the veterinary departments in the colleges and stations, and arranged with some of them for an exhibit intended to show: 1st, that veterinary science has its place in many of the agricultural colleges and experiment stations of the country; 2d, something of the character and scope of the instruction and work done; 3d, illustrations and samples of material or facilities in models, books, pathological specimens and instruments, used as aids in giving instruction or doing practical work; 4th, specimens of work done by students; 5th, specimens derived from experimental work.

Our college contributed towards this exhibit: One dissected horse, a number of models made by students of horses' teeth, taken in most instances from living animals, and intended to show the changes which take place in them from yearlings to advanced age; also a number of photographs illustrating various interesting features in connection with veterinary work in this college.

Besides taking charge of the veterinary alcove of the coöperative college and station exhibit, I was requested to prepare one to be shown with our college exhibit in the Liberal Arts building, and to make it possible for me to get them both ready in the short space of time left for the work, I was permitted to engage B. O. Johnson, D. V. S., a former student of our college, to assist with it. Of his faithful efforts, I can hardly speak too highly. Not only did he direct the students under him in an agreeable and profitable manner, but he did a large share of the manual part of the work, which consisted in the preparation of natural skeletons of the horse, cow, sheep and hog. It may not be out of place for me to say here that a natural skeleton is one in which the individual bones are held together by their *natural* ligaments, and not by wires or artificial ligaments, as is the case with the ordinary skeleton of commerce. To clean the bones of the former variety, in a presentable manner, requires much patience and time to *hand pick* them thoroughly. The bones of the artificial skeleton are cleaned by boiling, comparatively speaking a much easier process, but I do not think they make as interesting a specimen when mounted as the natural kind.

Besides the above skeletons we mounted two dissected horses, showing the deep seated muscles on one side, and the superficial ones on the other, we also took pains to dissect out ligaments affected in such diseases as curb, bog spavin, sprained fetlock, as well as parts affected in sweany, laminitis or chest found; coffin joint lameness, and many others not so often noticed. A great disappointment occurred with these horses through the work of installation being delayed at the fair, owing to the crowded condition of all freight departments, and the space in one building not being ready, they were exposed to the damp and mouldy atmosphere of Jackson Park for so long a time that they became mouldy to such an extent that they were practically ruined.

We also prepared models of horses' teeth in plaster of Paris, similar to those in the coöperative exhibit, and had another set of photographs developed.

The work of preparing these exhibits was done to a large extent during the long vacation and first half of the spring term. The class room work during the first two terms of 1893 was directed towards a description of the diseases of the domestic animals. Twenty-four lectures were given upon the drugs used in treating disease, the course of instruction being similar to that given in former years.

During the entire year our course of instruction was much benefited by cases coming to the college for treatment from time to time, which often afforded me the means of illustrating in a practical manner, that which was being taught in the class room.

OUTSIDE WORK.

Besides that already mentioned in connection with the Columbian Exposition, I issued an advance bulletin on the external conformation of the horse. I delivered an address before the State Breeders' Association and one before the State Veterinary Association. I delivered lectures at the various Farmers' Institutes which I was assigned to, and attended to the veterinary wants in the horticultural and agricultural departments.

In the capacity of State Veterinarian I visited many parts of the State and investigated reported outbreaks of contagious disease amongst the live stock.

I am, sir,
Yours obediently,
E. A. A. GRANGE,
Professor of Veterinary Science.

AGRICULTURAL COLLEGE,
June 30, 1893.

DEPARTMENT OF ENGLISH LITERATURE AND MODERN LANGUAGES.

To the President:

SIR—I have the honor to submit the following tabulated statement of the class room work done in the English department during the year 1893. It is necessary, merely, to observe that the freshman grammar named twice is the same class repeated, not two different terms of work done by the same men on the subject of grammar. So many new students enter in the spring term that it is thought better to repeat the grammar work of the fall term, rather than to have these freshmen wait until they become sophomores before giving them the opportunity to take this work.

The plan of the work done was the same as for the previous year, and for its nature. scope and success you are respectfully referred to the report for the year 1892.

During the summer term of the year 1893, the work of the department of psychology, logic and political economy was put in my charge, and Mr. Hedrick was appointed to meet the classes. This necessitated further help for the English department, and the Rev. Mr. Osborne was engaged to do a large part of the correction of essays and orations. Notwithstanding this excellent and efficient help, the work of the term was very heavy on us all, and we were glad when, in the fall term, the psychology, etc., was made again an independent department. with Mr. Hedrick at its head. In place of Mr. Hedrick. we secured Mr. D. J. Crosby. B. S., as our second assistant, and the excellence of his work has proven the wisdom of the choice.

The $800 allowed to the department for books became available during the fall term, and the purchase of some 700 new volumes has greatly increased the working value of the library. The department has also added five beautiful and valuable maps to its equipment.

Class work of the English department for the year 1893, beginning February 20 and ending November 10.

Class.	Term.	No. of divisions.	No. of hours per week for each division.	Total No. of hours per week for the class.	No. of students enrolled.
*Freshman Grammar	Spring	1	5	5	42
" Rhetoricals	"	3	2	6	75
" Rhetoric	Summer	3	5	15	77
" Grammar	Fall	3	5	15	54
" Prep. Grammar	"	1	5	5	17
" Rhetoricals	"	3	2	6	67
Sophomore Rhetoric	Spring	2	5	10	52
" Rhetoricals	"	1	2	2	20
" Rhetoricals	Summer	3	2	6	69
" Rhetoricals	Fall	4	1	4	81
Junior Rhetoricals	Spring	1	1	1	27
" German	"	1	5	5	16
" Rhetoricals	Summer	1	1	1	25
" German	"	1	5	5	11
" Rhetoricals	Fall	1	1	1	31
" German	"	1	5	5	21
" French	"	1	5	5	11
" American Masterpieces	"	1	2½	2.5	27
Senior Milton	Summer	1	1	1	41
" English Masterpieces	"	1	5	5	24
" " "	Fall	1	5	5	14
Total		35	70½	110	802
Names repeated					496
Total enrollment in the department					306
Average number of hours per week for each term				36⅔	

NOTE.—In addition to the above, each member of the teaching force of the department has corrected and returned to the students an average of nineteen foolscap sheets of manuscript per day during the year; and the head of the department has held private conferences and rehearsals for the orations of each junior and senior.

Respectfully submitted,
HOWARD EDWARDS.

AGRICULTURAL COLLEGE P. O.,
Nov. 10, 1893.

DEPARTMENT OF DRAWING.

To the President:

DEAR SIR—The following is the report of my work in the department of drawing for the college year 1892–3:

FALL TERM, 1892.

Freshmen mechanicals in mechanical drawing, two hours four times per week—eight hours.

Sophomore mechanicals in descriptive geometry, one hour each day—five hours.

SPRING TERM, 1893.

Freshmen agriculturals in freehand drawing; two divisions, two hours each—twenty hours.

Freshmen mechanicals in machine sketching: two hours, three days—six hours.

Sophomore mechanicals in machine design; three days, two hours—six hours.

A class of spring freshmen to bring up in mechanical drawing; time indefinite.

SUMMER TERM, 1893.

Sophomore mechanicals in elements of machine design—ten hours.

Freshmen mechanicals in descriptive geometry—five hours.

There have been no additions to the appliances of the department.

During the year I have had charge of the preparation of photographs for the college exhibit at the World's Fair.

The negatives of college views are now in the care of Mr. Edgerton, stored in carefully made cases. The college possesses a more or less complete outfit for printing from these negatives, and Mr. Edgerton will receive and fill orders for photographs.

Faithfully,

Agricultural College. W. S. HOLDSWORTH.

REPORT OF DEPARTMENT OF PHYSICS.

President:

SIR—I have the honor to make the following report of the department of physics for the year ending June 30, 1893:

Outside of my regular academic work, I have superintended the installation of electric lights in the armory and chapel, and extended the system in the library. I also spent five weeks of the winter vacation at farmers' institutes.

I have met during the past year seven classes for lectures or recitations and six classes for laboratory work. The following is an outline of the work:

Two classes in elementary physics. mechanical freshmen and agricultural sophomores, each five days per week. The term was given to the study of the composition and general properties of matter force and motion, systems of units, hydrostatics, specific gravity, hydrodynamics. properties of gases, atmosphere, barometer and apparatus dependent on air. Fully illustrated by lecture table experiments. This term is the first of a series of three terms, popular lectures and quizzes: supplemented by a class in quantitative laboratory work covering the same ground.

One class, second term, elementary physics. Mechanical freshmen, five days per week. Study sound and light. The topics in sound were its production, propagation, reflection and refraction, theory of music, analysis of sound and migratory motion. In light, velocity, photometry, reflection, refraction, dispersion, optical instruments, sources of light and polarization; lecture table experiments and laboratory class in measurements.

Two classes, third term, elementary physics. Mechanicel sophomores, five days per week, and agricultural juniors, five days per week (first half). Lectures and quizzes, first half: Heat, the dynamic theory, expansion, vapor tension, latent heat, hygrometry and specific heat. Second half: Magnetism, properties of magnets and processes of magnetization; electricity, its sources, the units of frictional machines, batteries, measurement of voltage, resistance and current; inductive currents, magneto and dynamo. As in preceding terms, the laboratory work is largely quantitative and students become familiar with apparatus and methods. Throughout the course in elementary physics, Atkinson's Ganot was used as a reference book.

One class in physics. Agricultural seniors, elective (number in class twenty-three). Class room work five days per week, and laboratory work five days per week. Subjects for both class and laboratory work were sound, light, electricity and magnetism, following much the same outline as given in elementary physics.

One class in electrical engineering. Mechanical seniors. Text book, Slingo and Brooker's Electrical Engineering. Five days per week, also electrical laboratory work four days per week. Lecture table apparatus used when applicable. The laboratory work as follows: Construction and calibration of a galvanometer adjustment of different elements and determination of electromotive series. Finding current strength by plating, by decomposition of water, by calorimeter. Determination relative values of horizontal and vertical components of earth's magnetism. Operation Wheatstone's bridge, magnetos, telephones, converters and accumulators. Determine characteristic of a series dynamo, a shunt dynamo, and a compound dynamo. Determination of efficiency of an electric motor.

Special class. Summer school. Laboratory practice ten hours per week (one-half term), consisted in work with instruments of precision and attainment of some knowledge of the methods of physical manipulation.

The department has made much progress during the past year. Apparatus has been added to the laboratory equipment making it possible to give a regular course of instruction in verification of physical formulæ. The new fifteen-horse power boiler and engine are of especial value in the work in electrical engineering, besides affording opportunity to the student to do experimental work for their graduating thesis. Experimental work should form a large and important element in the education of the young man who expects to follow any techinal line. This college should furnish as fast as possible a well arranged and adequate equipment, well up to the times, for the students' work in this department. The need for this training is fully acknowledged through the business world. Even now the well trained callege man may have difficulty in overcoming the prejudices entertained by practical men. It is necessary the work done here unite the practical with the theoretical, so as to enable our graduates to command the confidence and respect of those who intrust their interests to his knowledge and skill.

As in past reports, this department continues to have urgent and immediate needs both for the laboratory work in physics and electrical engineering, and the lecture table.

Most respectfully submitted,
PHILIP B. WOODWORTH,
Assistant Professor of Physics.

AGRICULTURAL COLLEGE,
June 30, 1893.

REPORT OF THE DEPARTMENT OF MATHEMATICS AND CIVIL ENGINEERING.

President O. Clute:

DEAR SIR —Perhaps the most notable fact for record in the administration of this department for the past year, is the successful working of the new arrangement of mathematical studies in both the agricultural and mechanical courses. It is too early to declare the schedule satisfactory in all its parts, but it is pleasant to note some of the benefits already apparent. Not the least of these is a considerably diminished irregularity of classification. We think, too, that an improvement in extent of ground covered and knowledge gained by the students can be credited to the new order of studies. The instructors of the department have been able to make more economical disposition of their time and have rendered more efficient service, by reason of the possibility of concentrating their energies on a few studies each term.

There have been no changes in the teaching force of the department. Professor F. W. McNair and Instructor W. Babcock, Jr., have shared with me the work of instruction, and by wise and timely counsel and help, have assisted to secure whatever measure of success may be credited to the year's work. Perfect harmony, so essential to the best work of any department, has existed here, and I have nothing of criticism to offer on the labors of the gentlemen named, but much in commendation.

During the fall term, '92, owing to the press of work necessitated by the transition from the old mathematical schedule to the new, a class in preparatory arithmetic was satisfactorily tutored by Mr. A. F. Gordon, a graduate of this college.

INSTRUCTION.

The number of classes taught by this department in each term, and the total enrollment, are set forth in the following tabulation.

Summer term, 1892. Juniors, one class in mechanics of engineering. Sophomores, one class in analytic geometry and one class in differential calculus. Freshmen, two classes in geometry and one class in algebra. Enrollment in these classes, 151.

Fall term, 1892. Seniors, one class in graphic statics. Juniors, one class in integral calculus. Sophomores, one class in trigonometry, two classes in algebra and one class in geometry. Freshmen, two classes in algebra and a preparatory class in arithmetic. Total enrollment, 212.

Spring term, 1893. Seniors, one class in civil engineering. Juniors, one class in mechanics of engineering. Sophomores, one class in analytic geometry, and one class in surveying, with afternoon practice in the field. Freshmen, 1 class in geometry and three classes in algebra. Total enrollment, 206.

Several subjects have been added to the list taught by this department. Among the elective courses offered to seniors in agriculture, is one calling for two terms' work with us. The first term's work is in civil engineering, so called, but is properly an extension of the earlier work in surveying, and is largely preparatory to the second term's work under the title of agricultural engineering. The latter embraces principally so much of the engineering operations connected with land drainage, road construction and the building of ordinary highway bridges, as is possible to include in a term of twelve weeks, one hour daily. The subject of hydraulics is inserted in the new schedule of studies as an elective subject for mechanical seniors, and solid analytic geometry is displaced by graphic statics.

EQUIPMENT.

There has been few additions to our instrumental equipment during the year. Several surveying instruments have been overhauled and repaired by the makers, and we have made for our own use eleven ironshod rods or "flags," and two stadia rods. Through the kindness of the Artificial Stone Co., of Lansing, we acquired by gift an assortment of drain tiles, sewer pipes and cement pipes, both straight sections and specials, to be used for illustration in the engineering classes. The above, with a slide rule of latest design and a few small tools, constitute all additions and improvements made up to the date of this report.

As stated in my last annual report, an appropriation of $300 was made early in the year by the Board of Agriculture, for the purchase of books by this department for the general library. Of that sum, $217 was carefully, and, I think, judiciously expended. The remainder of the sum appropriated was withdrawn from availability in December, 1892.

PRACTICAL ENGINEERING.

The plans for the sewerage of the college grounds, first submitted about a year ago, have been extended, and the lines are staked out in anticipation of a favorable consideration of the plans by the board. A small map of the grounds and farm has been prepared for the use of the board. Plans for the drainage of the cellar of Howard Terrace, and sewerage for the same building, have been submitted.

In conclusion, let me thank you, sir, for your continued help and support, and acknowledge my many obligations to you for assistance in making the past year a prosperous one for the department.

All of which is very respectfully submitted,

H. K. VEDDER.

AGRICULTURAL COLLEGE,
June 30, 1893.

REPORT OF THE DEPARTMENT OF HISTORY AND POLITICAL ECONOMY.

To the President of the Michigan Agricultural College:

I have the honor of submitting the following report:

The department of History and Political Economy came into my hands at the beginning of the summer term in 1893. Two classes of seniors presented themselves for instruction; one numbering twenty-three for work in civil government and United States history, the other numbering eighteen for work in political economy. The work of the first class was based upon Luske's Civil Government and Johnston's American Politics. An attempt was made to combine a considerable amount of outside reading with text book work, and an arrangement was entered into by which those reporting upon a certain number of references to such books as Bryce's American Commonwealth, Schouler's Adams' and McMasters Histories of the United States, etc., were exempt from examination at the end of the term. A number of written reviews during the term, close attention to recording daily standings and an examination of the reports on references submitted for the final examination. An attempt was made throughout the course to get an understanding of the present political problems in city, state and nation, and to note the causes, progress and settlement of our past political problems. The interest shown by students in these questions was gratifying to the teacher and complimentary to themselves.

The work in political economy being shortened by two weeks of vacation at the end of the term little work was done outside of the text book. Walker's Political Economy was the basis for this work, and some special attention was given to such economic problems as trades unions, taxation, coöperative business and the use of money.

By a vote of the faculty during this term an agreeable change was made in the course of study for this department in the substitution of English for Ancient History. So much of the subsequent work of the student in economics, philosophy, English and American literature and American history is somewhat dependent upon this study that the change is in every way commendable. With the recommendation that some books in history be purchased to fill out incomplete sets now owned, and that some recently published works in economics be added to the library this brief report is finished.

Respectfully submitted,
WILBUR O. HEDRICK,
Assistant Professor of History and Political Economy.

REPORT OF THE LIBRARIAN.

President O. Clute:

I have the honor to present the following report on the library, for the year ending June 30, 1893:

The growth of the library during the year has been as follows: Bound volumes, purchased, 334; donated, 124; by binding, 204; total, 662. Unbound volumes and pamphlets, purchased, 55; donated, 408. Total additions, 1,143.

The library now numbers 15,621 bound volumes, and about 4,142 unbound volumes and pamphlets.

We are indebted to the following for bound donations:

- Appleton, F. H.—Massachusetts Agriculture, 1792–1892.
- Brownless, A. C.—Melbourne University Calendar, 1893.
- California—Horticulture, 1892.
- Canada—Journals of the Legislative Assembly.
  - " " " Council.
  - Sessional Papers.
- Corbin, Mrs. N. D.—Harper's Intro. Geography.
- Godwin, D. J.—Resources of Tennessee.
- Goodman, L. A.—Missouri Horticulture, 1891.
- Hammond, A. C.—Trans. Ill. Horticultural Society, 1892.
- Hitchcock, C. W.—Michigan Medical Ass'n, Report, 1892.
- Indiana.—Agriculture, 1891–'92.
  - Trans. Horticultural Society, 4 vols.
- Illinois.—State Dairymen's Association Report, 1892.
- Loomis, M. F.—Cyclopedia of printing.
- McMillan, Hon. J.—Senate Ex. Doc., vol. 10.
- Massachusetts.—Agriculture, 1892.
- Meadville Theological School.—Tools and the Man.
- Michigan Reports.—Agriculture, 1891.
  - Corrections and Charities, 1891–92.
  - Documents from Secretary of State, 23 vols.
  - Labor Bureau, Tenth Annual Report.
  - Pioneer Collections, vols. 19, 20.
  - State Board of Health Report, 1890.
  - State Horticultural Society Report, 1891.
  - Supreme Court Reports, 4 vols.
- Minnesota.—Horticulture, 2 vols.
- Missouri.—Horticulture, 1891.
- Mohler, M.—Kansas Agriculture, 1891–92.
- Morrison, W. K.—Wisconsin Farmer's Institutes, 1891.
- Nesbitt, R. T.—Georgia Agriculture, 1892.
- North Dakota.—Agriculture and Labor, 1891–92.
- Ottawa, Department of Agriculture.—Studies in Plant Life in Canada.
- Pilcher, J. E.—Life and Labors of Elijah H. Pilcher.
- Present to Youths and Young Men, 2 vols.
- Richmond, O. H.—Temple Lectures.
- Smithsonian Institution.—Report, 1890.
  - Bureau of Ethnology, Seventh Annual Report.
  - Contributions to Knowledge, vol. 28.
  - Contributions to North American Ethnology.
  - Proc. U. S. Nat. Museum, vol. 14. Report, 1889.
- Stockwell, G. A.—Rhode Island Agriculture, 1887.
- Stout, Hon. B. G.—U. S. Coast and Geodetic Survey Report, 1890.
- Texas.—Agriculture, 1891.
- U. S. Department of Agriculture.—4.
  - Interior, Pub. U. S. Geol. Survey.
  - Navy, 3 vols.
  - State, Commercial Relations, 1890–91.
  - Treasury, 2 vols.
  - War, 15 vols.
  - Labor Commissioner, Report 1891.
  - Proc. Nat. Conference of Corrections and Charities, 1892.
  - R. R. Commisioner, Statistics of Railroads, 1891–92.
- Vermont.—Agriculture, 1891–92.
- Virginia.—Agriculture, 1892.
- Winchell, N. H.—Geol. Survey of Minn., Bulletin, No. 7.
- Wisconsin.—Horticulture, 1891–92, 2 vols.
  - State Dairy and Food Commissioner Report, 1892.

Unbound Donations.

American Acad. of Medicine, 1.
  Museum of Nat. History, 2.
  Pomological Society, Proc. 1891.
  Society of Mech. Engineers, Trans., vol. 13.
Australian Museum, Records 4, Report 1891.
Brisbane.—Agriculture, 2 vols.
Canada.—Geol. and Nat. Hist. Survey, 3, Report 1888–89.
  General index to J'l of Legislative Assembly.
Canadian Institute.—Trans.
  Paleontology.
California.—Horticultural Society, 8.
  Viticulture, Report 1891.
Cincinnati.—Society of Nat. History, 4.
Clotten, F. E.—J'l of the British Dairy Farmer's Ass'n, vol. 7.
Clute, Pres. O.—Memorial; Dr. T. C. Abbott.
Colorado.—Agriculture.
Consular Reports.—16 numbers.
Essex Institute.—Vol. 24.
France.—Agriculture, 10.
Geol. and Nat. History Survey of Minn., 2 N. H. Winchell.
Indiana.—Academy Nat. Sciences, Proc. 1891.
Illinois.—Agriculture.
Johns Hopkins Univ., 1.
J'l. Elisha Mitchell Scientific Soc., F. P. Venable.
Kansas.—Historical Society, Report 1890–92.
Kellogg, V. L.—Injurious insects.
Louisiana.—Agriculture, 1892.
Madras.—Agriculture.
Massachusetts.—Horticulture Report, 1891; Rob't. Manning.
Michigan State Library.—U. S. Statute's, 17.
Minnesota.—Horticulture.
New England.—Hist. and Geneological Register.
N. S. Wales.—Agricultural Gazette.
New York.—Meteorology, D. Draper.
Ohio.—Meteorology, 1891.
Ontario Reports.—Bee Keeper's Ass'n, 1891.
  Commission for dehorning cattle.
  Central Farmer's Institutes.
  Dairymen's Association.
  Poultry and Pet Stock Association.
Pickering, E. C.—Chron. History of plants.
Quebec.—Commissioner of Agriculture, 6.
Rhode Island.—Agriculture, 3.
Royal Botanic Gardens, Trinidad, Report, 1891. J. H. Hart.
Smithsonian Institution.—28.
Tennessee.—State Board of Health, Bulletins.
United States.—Coast and Geod. Survey.
  Geological Survey, 4.
  Department of the Interior, Census Bulletins.
    Bureau of Education, 1.
  Navy Department Report, 1891, Naval Observatory.
  State Department, Bureau of American Republics, 2.
  Treasury Department Quarterly Reports, Bureau of Statistics.
    Foreign Commerce, 1892.
  War Department, Army Directory.
    General Atlas, 9 parts.
Virginia.—Agriculture, 1892
Waterhouse, S.—2.
Wheeler, C. F.—Flora of Michigan.

The reading room is supplied with the following periodicals.

PURCHASED.

FOREIGN.

- Agricultural Gazette.
- Annals of Botany.
- Analyst.
- Australasian.
- Blackwood's Magazine.
- Canadian Entomologist.
- Chemical News.
- Edinburgh Review.
- Electrician.
- Engineering.
- Englische Studern.
- Garden.
- Gardener's Chronicle.
- Gardening World.
- Journal of Anatomy.
- Journal of Chemical Society.
  - Horticulture.
  - Royal Agricultural Society.
  - Royal Microscopical Society.
- Lancet.
- Magazine of Art.
- Mind.
- N. British Agriculturist.
- Phil. Trans. of the Royal Society of London.
- Proceedings of the Royal Society of London.
- Revue General de Botanique.
- Revue Horticole.
- Veterinarian.
- Veterinary Journal.
- Westminster Review.

AMERICAN.

- Agricultural Epitomist.
  - Science.
- American Agriculturalist.
  - Bee Journal.
  - Cheese Maker.
  - Chemical Journal.
  - Cultivator.
  - Dairyman.
  - Florist.
  - Gardening.
  - Journal of Mathematics.
    - Science.
  - Machinist.
  - Manufacturer and Iron World.
  - Meteorological Journal.
  - Microscopical Journal.
  - Naturalist.
  - Veterinary Review.
- Andover Review.
- Annals of Mathematics.
  - Amer. Acad. Political Science.
- Arena.
- Army and Navy Journal.
- Art Amateur.
- Astronomy and Astro-Physics.
- Atlantic.
- The Auk.
- Bacteriological World.
- Beekeeper's Review.
- Botanical Gazette.
- Breeder's Gazette.
- Bulletin of the Torrey Botanical Club.
- California Farmer.
- Catalogue of U. S. Publications.
- Century Magazine.
- Chicago Times.
- Christian Union.
- Contemporary Review.
- Cosmopolitan.
- Country Gentleman.
- Dakota Farmer.
- Detroit Free Press, daily.
- International Journal of Ethics.
- Jersey Bulletin.
- Johns Hopkins University Studies.
  - Circulars.
- Journal of Analytical Chemistry.
  - Association of Am. Engineers.
  - Comparative Medicine.
  - Franklin Institute.
  - Morphology.
- Judge.
- Kansas Farmer.
- Magazine of American History.
- Mechanics Monthly Magazine.
- Michigan Farmer.
- Microscope.
- Modern Language Notes.
- Nation.
- Nature.
- New York Tribune.
- News and Courier.
- Nineteenth Century.
- North American Review.
- Northwestern Lumberman.
- Ohio Farmer.
- Ornithologist.
- Pacific Rural Press.
- Proc. Academy of Natural Sciences.
  - American Philosophical Society.
  - Boston Society of Natural History.
  - Entomological Soc'y of Washington.
- Political Science Quarterly.
- Poultry Journal.
  - World.
- Popular Science Monthly.
- Power.
- Prairie Farmer.
- Price Current.
- Public Opinion.
- Publication of the Am. Economic Society.
- Psyche.
- Puck.
- Railroad and Engineering Journal.

Detroit Tribune, daily.
Drainage Journal.
Economics Quarterly.
Education.
Educational Review.
Electrical World.
Engineering Mechanics.
Engineering News.
Entomological News.
Farmer's Review.
Farm Implement News.
Fortnightly Review.
Forum.
Garden and Forest.
Gardening.
Harper's Monthly.
    Weekly.
Independent.
Industry.
Railroad Gazette.
Republic.
Review of Reviews.
Rural New Yorker.
Shakespeariana.
Science.
Scientific American.
    Supplement.
Scribner's Magazine.
Southern Cultivator.
Technical Index.
Trans. American Entomological Society.
    of the Linnean Society.
University Extension.
Vick's Monthly.
Voice.
Weekly Bulletin.
Western Farmer.
World's Columbian Exposition.

Donated or received in exchange:

Adrian Weekly Times.
Albion Recorder.
Allegan Gazette.
American Creamery.
    Horse Breeder.
    Missionary.
    Sentinel.
    Swineherd.
Avalanche.
Baltimore.
Cadillac News and Express.
Charlevoix Democrat.
Charlotte Republican.
Christian Register.
Clinton Independent.
Coldwater Republican.
Dairy Column.
    Messenger.
Deaf Mute Mirror.
Evening News, Saginaw.
Farm, Field and Fireside.
Farm and Fireside.
Farm and Home.
Farm Journal.
Farmer's Advocate.
    Home.
    Journal.
Fruit Grower's Journal.
Good Health.
Grand Rapids Democrat.
Grand Traverse Herald.
Grange Bulletin.
    Visitor.
Hillsdale Leader.
    Standard.
Hoard's Dairyman.
Holstein Fresian Register.
Home Companion.
Homestead.
Hospidor.
Industrial American.
Industrialist.
Ingham County News.
Ionia Sentinel.
Jonesville Independent.
Journal of Agriculture.
    N. Y. Microscopical Society.
Kalamazoo Weekly Telegraph.
Lansing Journal, Daily.
    Weekly.
Literary News.
Locomotive.
Louisiana Planter.
Mail and Times.
Maryland Farmer.
Mid-Continent Magazine.
Midland Republican.
Mirror and Farmer.
Moderator.
Monthly Weather Review.
National Stockman and Farmer.
Official Gazette.
Orange Judd Farmer.
Pharmaceutical Era.
Practical Farmer.
Roscommon D.
Saginaw Courier Herald, Daily.
Social Economist.
State Democrat.
    Republican.
Sugar Beet.
Toledo News.
Three Rivers Tribune.
Traveler's Record.
Traverse Bay Eagle.
University Record.
Weekly Bulletin.
    Free Press.
    Review.
Western Agriculturist.
    Plowman.
    Swineherd.
Wisconsin Farmer.
Wolverine Citizen.
World, N. Y.

The library is open to students about fourteen hours daily. 3,414 books have been loaned during the year; no record is made of books used in the room, or of those in the various department offices.

During the winter the library was classified according to the "Cutter" system of classification, and a new card catalogue, on the dictionary plan commenced. The work was under the direction of Miss Annie White, of the Boston Athenaeum, assisted by H. M. Goss, H. Lake and the librarian. The work of accessioning and shelf-listing the books was also begun, and is still in progress. The work assigned to students has been most satisfactorily performed.

The books in the experiment station library have also been classified, catalogued, accessioned and shelf-listed. The library now numbers 1,174 bound volumes, not including experiment station reports.

Additions have been made as follows: Bound volumes, by purchase, 70; by gift, 7; by binding, 59, total 136. Unbound volumes and pamphlets, by purchase, 148; by gift, 29; total, 147.

We also receive the publications of the U. S. Department of Agriculture, and the bulletins and reports of the various state experiment stations.

The bulletins used by the various experiment stations have been carefully preserved, files completed and bound in 46 volumes, complete to 1893. These books with a complete set of the journal of the Royal Microscopical Society (1878–1893), form the most valuable additions made to the library during the year.

LINDA E. LANDON,
Librarian.

SIXTH ANNUAL REPORT

OF THE

AGRICULTURAL EXPERIMENT STATION

OF THE

STATE AGRICULTURAL COLLEGE OF MICHIGAN

FOR THE

YEAR ENDING JUNE 30, 1893.

[For members and organization of the State Board of Agriculture in charge of the station and the list of officers, see pp. 4 and 5 of this volume.]

EXPERIMENT STATION.

The work of the station during 1892–3 has continued along the same lines as during the previous year. The usual number of bulletins were issued and the demand for them by the people of the State has greatly increased and still but a limited number of the farmers of the State receive them. It will be the aim in the future to secure a larger circulation of the bulletins among those who are entitled to receive them.

I. H. BUTTERFIELD,
Secretary.

REPORT OF THE SECRETARY AND TREASURER FOR THE YEAR ENDING JUNE 30, 1893.

July 1, 1892	—To balance on hand	$618 33	
Aug. 2, 1892	— " U. S. treasury on account of, 1st quarter	3,750 00	
Nov. 5, 1892	— " " " " " " 2d "	3,750 00	
Jan. 9, 1893	— " " " " " " 3d "	3,750 00	
May 23, 1893	— " " " " " " 4th "	3,750 00	
June 30, 1893	—To license fees on 50 commercial fertilizers	1,000 00	
" "	—To miscellaneous receipts as per accounts filed in the office of the State Auditor General	1,037 05	
" "	—By disbursements as per vouchers filed in the office of the State Auditor General		$18,150 63
" "	—To balance overdrawn	495 25	
		$18,150 63	$18,150 63

SUMMARY OF DISBURSEMENT ACCOUNT.

Buildings—		
To completion of farm department seed room	$258 12	
To completion of apartment house	2,486 01	
		$2,744 13
Salaries—		
To director	$500 00	
Secretary and treasurer	500 00	
Librarian	120 00	
three heads of departments	1,500 00	
twelve assistants	5,957 76	
		8,577 76

Farm Department—		
To labor	$519 15	
lambs, $144.50; apparatus, $74.71; other property, $81.35; seeds, $49.41	649 97	
stationery, postage and freight, $109.45; feed, $324.79	434 24	
thermometers which were resold	150 00	
sundry	129 84	
		$1,883 20
Grayling Substation—		
To labor	$708 49	
fertilizers, $132.88; seeds, $51.39; travel, $53.69; sundry, $21.48	259 44	
		967 93
South Haven Substation—		
To labor	$1,397 75	
rent, $69.26; travel, $25.85; seeds and plants, $13.44; fertilizers, $106.85	215 40	
sundry	67 52	
		1,680 67
Other Substations—		
To travel, $20.25; rent, $15.00		35 25
Library—		
To books		500 68
Offices—		
To traveling and convention expenses	$148 11	
mailing list, $74.32; copying press, $40.00; stationery, $10.85	125 17	
weather service, $113.45; sundry, $2.40	115 85	
		389 13
		$18,150 63

This expenditure may be more briefly summarized and classified as follows:

Salaries of officers at central station	$8,577 76
Wages	3,086 65
Buildings	2,744 13
Other property	1,516 94
Seeds and plants	172 36
Traveling expenses	321 35
Feed and fertilizer	637 32
Miscellaneous	1,094 12
	$18,150 63

As the provisions of an act of congress approved March 2, 1887, under which this experiment station is organized, limit the amount of each year's appropriation which may be used for building purposes to 5 per cent of such appropriation, and also require that the entire appropriation for each year shall be expended during that year in order to entitle the station to receive the full amount of the following year's appropriation, it is necessary to make the following divided statement of the above account.

GENERAL ACCOUNT OF EXPERIMENT STATION.

By balance on hand from last fiscal year		$618 33
receipts from U. S. treasurer for fiscal year		15,000 00
other sources		2,037 05
To disbursements from funds rec'd from U. S. for buildings	$750 00	
other purposes	14,250 00	
other sources for buildings	1,994 13	
sundry sources for other purposes	1,156 50	
balance overdrawn		495 25
	$18,150 63	$18,150 63

INVENTORY.

Lands donated to the station—		
80 acres at Grayling, fenced and improved	$1,850 00	
5 " " So. Haven, " " "	500 00	
		$2,350 00
Buildings—		
Experiment feed barn	$1,200 00	
Horticultural laboratory, experimental rooms	1,200 00	
Veterinary laboratory, experimental rooms	250 00	
Apiary	600 00	
Forcing house	1,500 00	
Feed mill	100 00	
Sub-faculty building	3,500 00	
Seed room	725 00	
		$9,075 00
Library and offices of director and secretary—		
1,057 books	$2,165 00	
Files, cards, cases, etc.	114 00	
Furniture, etc.	75 00	
One mailing list in type	246 08	
		2,600 08
Farm department—		
Twelve head cattle	$945 00	
Twenty-eight sheep	75 00	
Office equipment	376 00	
Tools	466 40	
		1,862 40
Horticultural department		
One horse	$100 00	
Office furniture, implements, etc.	800 07	
		900 07
Chemical department—		
Thermometers, $154.20; balances, $550.45; platinum, $250.85; sundry apparatus, $975.35		1,930 75
Botanical department—		
Microscopes and accessories	$312 50	
Furniture and sundry apparatus	186 69	
		499 19
Veterinary department—		
Instruments and sundry apparatus		725 00
Zoölogical department—		
Microscopes, cases, etc.		574 10
Apiary—		
Bees, stock and tools		500 00
Total		$21,016 59

REPORT OF THE AGRICULTURIST.

To the Director:

Since writing my last annual report Feb. 1, 1893, two bulletins have been issued by this department, both upon potatoes. The first upon amounts of seed being especially exhaustive of the subject. The many complimentary notices of this bulletin have been gratifying to all concerned in its make up.

The interesting experiment in lamb feeding in progress during the winter has been completed and the material is now practically ready for publication. Some investigations have also been made into the practicability of silage as a commercial product, also as to its feeding value. Experiments in horn killing with various compounds and dehorning have been made. A large amount of experimentation has been begun in relation to corn smut; to determine its life history, methods of infection and preventatives therefor. In this work since the retirement of Mr. Holden I am under great obligations to Mr. C. F. Wheeler, the efficient botanist of the station, who has practically taken charge of the experiment, also to the chemical department for counsel and material.

The plat experiment to determine the personal equation preparatory to important fertilizer experiments covering long periods, which were begun some years since, have been continued.

Experiments upon the smut of oats and barley, different methods of treatment; corn selection, deep and shallow cultivation, different distances apart, hills vs. drills, different amounts of seed and varieties for silage purposes, roots, the most profitable kind and cost of growing for field crops; grass, best kind for meadows; various leguminous plants for fodder purposes, have all been begun, and will undoubtedly be reported upon by my successor, either by bulletins or otherwise in due season.

At Grayling practical methods of improving the soil by growing and plowing in spurry and the application of cheap fertilizers, such as ashes and land plaster have been outlined placed in the hands of Dr. Palmer who has been so long connected with that station. Some tests are also being made there with chemical fertilizers and some new plants are being tested. The doctor will undoubtedly report upon these at the close of the year.

I have to thank all those who have heartily coöperated with me in this work, and wish the highest success to those who take it up after me.

P. M. HOWARD,
Agriculturist.

AGRICULTURAL COLLEGE }
June 30, 1893. }

REPORT OF THE HORTICULTURIST.

To the Director:

SIR—Although the early part of the season of 1893 was quite favorable for the development of garden crops, the severe drought which lasted from the early part of July until the last of August, cut short many that matured late in the season. As might be expected, the wet weather of early spring was quite favorable to the development of fungi, but, as it became dryer, the injury was noticeably decreased.

The results obtained from the experiments of 1892 were compiled and sent out in bulletins. From the fact that much of the time of my assistants and myself was taken up with closing up the fall work, and during several weeks in the winter, in attending farmer's institutes in different parts of the State, the preparation and distribution of the bulletins was considerably delayed. In spite of this, however, the bulletins were in the hands of the farmers in season for their use the following year. Were outside duties not allowed to interfere, the results of nearly all of our experimental work could be compiled and in the printer's hands by the first of January. The farmers would then receive the bulletins at a time when they have ample leisure to examine them.

The following bulletins were issued: No. 88, Fruit Report, South Haven, December, 1892; No. 90, Vegetable Tests, February, 1893; No. 92, Small Fruit Notes; Spraying, August, 1893; No. 100, Eighty New Strawberries, August, 1893. We also have nearly if not quite ready for the printer, the following: Peach and Plum Culture in Michigan; A Year Among Fruits (South Haven); Michigan Fruit Notes; Strawberries and Raspberries; The Potato and Potato Scab; Notes on New Vegetables.

VARIETY TESTS OF FRUITS.

In most respects the strawberry crop would be pronounced a success, as the fruit was large and perfect. Many of the varieties were considerably troubled by leaf rust, and on such sorts the fruits dried up before ripening. In addition to one hundred and fifty old kinds, we fruited eighty new sorts for the first time in 1893, and as soon as possible after the crop was harvested, our notes and conclusions were written up and published in bulletin No. 100.

Up to the first of July, the raspberry and blackberry crop promised well, but it was cut short by the drouth. The old cherry trees bore a full crop, and a few of the young ones gave a sufficient number of fruits to indicate the value of the variety, so far as the characteristics of the fruit are concerned. The results with plums and peaches were quite similar to those with cherries. The pears gave a small crop, but the apple trees were so weakened by the unfavorable conditions of the previous year, that the crop was very light. Many of the trees of all kinds in the young orchards give promise of a good crop in 1894.

INSECTS AND FUNGI.

From the fact that the frequent rains during the early part of the season rendered the application of remedies, at the proper time, quite difficult, and because the dry weather of midsummer put a stop to the development of the fungi, the results obtained from our experimental work in the line of fungicides, were not as striking as would have been the case under different circumstances; yet, in every case where there was any noticeable amount of fungi, the application of fungicides had a good effect. The best results however, were obtained at the South Haven substation, where very beneficial results were secured in the treatment of peach leaf curl, peach and plum rot, grape mildew, raspberry anthracnose, strawberry leaf blight and the diseases of the currant, gooseberry and quince.

Early in the season arrangements were made with a number of fruit growers in various sections of the State for coöperative work with fungicides, and although, for various reasons, the results were not as good as might be desirable, the persons who undertook the experiments and many of their neighbors were so impressed with the value of the treatment that they expect to spray thoroughly their entire orchards the coming season.

As an indication of the use of fungicides, it may be said that while the amount of copper sulphate used in the State for this purpose in 1892 was less than 1,000 pounds, it increased in 1893 to at least five tons and from present indications it is not likely to be less than twenty-five tons in 1894.

The cheapest and most efficient fungicide found up to the present time is the well known Bordeaux mixture, and as the arsenites can be more safely applied when used in combination with lime, the use of the two remedies, at one time, lessens the cost of application, and increases the efficiency of both.

As there were many calls for information on this subject, a portion of bulletin 92 was devoted to this subject.

The discovery of the cause of potato scab, and the remedy for it, seemed to warrant some attention to learn the proper strength and duration of time for the application. The experiment was so complete in all its details that we shall be able to announce to the farmers a way of increasing the value of the potato crop of the State from ten to twenty-five dollars per acre at an expense not exceeding ten cents.

The method of treatment found to be best is not essentially different from that of Prof. Bolley, who first discovered the nature of the disease.

FERTILIZER TESTS.

The field tests of commercial fertilizers upon both fruits and vegetables was continued about as in previous years. We also did something in the way of coöperative work with these materials in different parts of the State. This was done in order that we might learn whether commercial fertilizers could be applied with profit to fruit crops. As the tests were carried on in fruit growing districts, it also gave the neighboring fruit growers an opportunity to judge for themselves as to the profitableness of the application.

VEGETABLE TESTS.

The work of testing the novelties in vegetables sent out by the seedsmen has been kept up, and the usual report will soon be issued. While the number of novelties is rather less than in past years, it could be still further reduced without loss to the gardener, as a large part of them are less valuable than many of the old sorts.

DISTRIBUTION TO SUBSTATIONS.

As our supply of nursery trees increases we are able to do more in this line, and in 1893 the number of persons supplied was more than twice as large as in previous years, and the increase in the number of trees was even greater. The propagation of the trees affords excellent practice for the students, and by sending them out as above we are not only able to secure a careful trial of the trees in various parts of the State, but are able to place them at points from which they can be distributed among the farmers of the different localities.

SOUTH HAVEN SUBSTATION.

The work at this point has been continued under the care of the well-known pomologist, T. T. Lyon, and as the trees first planted are now coming into bearing, from this time on, the value of the results will gradually increase. In addition to the variety testing, much valuable work has been done the past year in the line of fungicide tests. The report for the year is now in the printer's hands and will be published as Bulletin 104.

Some of the trees and plants, notably the cherries, raspberries and strawberries, were more or less injured by the extremely wet weather of the spring of 1892, but they have now nearly, if not quite, recovered. During the year we have increased the number of tile drains where it has seemed necessary, and no further trouble is anticipated.

The trees in the station orchard at Grayling have made a fair growth considering the conditions, and thus far appear to be entirely hardy. While it is not likely that any large proportion of the Russian varieties will prove valuable in most sections of the State, their superior hardiness may make them desirable at the north.

In my experimental work I have been aided by Mr. H. P. Gladden and Mr. R. J. Coryell, who have acted as assistants for several years. The work has for the most been divided between them, and, with the help of the students of the upper classes, the crops have been grown by them and the notes taken.

Very respectfully,
L. R. TAFT.

AGRICULTURAL COLLEGE,
Dec. 31, 1893.

SUMMARY OF METEOROLOGICAL OBSERVATIONS AT THE MICHIGAN AGRICULTURAL EXPERIMENT STATION FOR THE YEAR 1892.

IN CONTINUATION OF THE SAME SERIES OF OBSERVATIONS RECORDED FOR THE MICHIGAN AGRICULTURAL COLLEGE SINCE 1863.

BY R. C. KEDZIE, PROFESSOR OF CHEMISTRY AND CHEMIST OF THE STATION.

[Latitude 42° 43′ 56″, longitude 7° 25′ 61″, height above sea, 834 feet.]

Months, 1892.	Mean daily temperature in open air.	Percentage of humidity, saturation=100.	Pressure of vapor of water.	Height of barometer, reduced to temperature of 32° F.	Percentage of cloudiness.	Self registering thermometer.		Amount of rain or melted snow in inches.	Snowfall in inches.	Number of thunder-storms.
						Maximum.	Minimum.			
January	19° .2	86	.098	29.064	63	27°.32	6.55	.96	10	----
February	27 .3	86	.139	29.133	79	34 .66	17.72	1.93	10.5	----
March	29 .86	77	.129	29.121	52	39 .00	19.90	1.31	5.	----
April	44 .50	63	.202	29.107	50	54 .93	32.77	2.04	1.	1
May	54 .5	76	.322	29.003	70	63 .19	45.71	5.92	--------	4
June	67 .70	83	.561	29.019	59	75. 70	59.03	4.33	--------	10
July	70 .29	73	.539	29.178	32	81 .48	58.23	2.00	--------	3
August	68 .30	75	.521	29.111	37	78 .74	57.87	5.12	--------	1
September	60 .80	77	.418	29.132	41	73 .23	50.20	2.17	--------	3
October	48 .30	78	.281	29.096	42	60 .32	36.98	.78	--------	----
November	34 .20	83	.169	29.098	82	41 .97	25.77	1.84	2	----
December	25 .59	89	.113	29.092	83	30 .90	17.06	1.52	2	----
Years	45°.88	78	.291	29.096	57.5	55 .03	35.64	29.92	30.5	22

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.				Relative humidity or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	41	42	47	43⅓	82	66	77	.212	.177	.249	28.629	28.612	28.448	28.563
2	28	21	16	21⅔	88	100	83	.135	.113	.074	28.368	28.636	28.821	28.608
3	14	21	14	16⅓	81	71	81	.067	.080	.067	28.997	28.986	28.959	28.981
4	18	24	20	20⅔	100	86	100	.098	.111	.108	28.719	28.640	28.717	28.692
5	0	25	16	13⅔	69	86	100	.030	.111	.090	28.776	28.757	28.765	28.766
6	18	26	21	21⅔	100	75	100	.098	.105	.113	28.668	28.664	28.711	28.681
7	11	11	10	10⅔	100	100	100	.071	.071	.068	28.731	28.761	28.896	28.796
8	17	17	11	15	83	100	100	.078	.094	.071	28.780	28.872	29.031	28.894
9	0	10	–2	2⅔	100	78	100	.044	.054	.040	29.194	29.273	29.380	29.282
10	7	15	12	11⅓	100	64	100	.032	.055	.075	29.482	29.495	29.496	29.491
11	12	20	22	18	100	85	100	.075	.091	.118	29.413	29.242	29.128	29.261
12	21	23	12	18⅔	100	86	100	.113	.106	.075	29.241	29.341	29.379	29.320
13	12	19	17	16	100	84	83	.171	.082	.078	29.253	29.189	29.144	29.195
14	15	22	10	15⅔	100	58	78	.086	.068	.054	29.169	29.259	29.369	29.266
15	–13	11	3	⅓	100	79	100	.025	.057	.050	29.499	29.442	29.467	29.489
16	0	25	17	14	100	60	83	.044	.077	.078	29.508	29.395	29.331	29.411
17	22	29	25	25⅓	71	66	87	.084	.105	.117	29.287	29.254	29.286	29.276
18	12	14	10	12	100	100	100	.075	.082	.068	29.325	29.278	29.297	29.300
19	4	15	–8	3⅔	73	82	29	.038	.070	.011	29.276	29.264	29.304	29.281
20	1	14	13	9⅓	70	63	81	.032	.051	.063	29.268	29.228	29.217	29.238
21	13	28	18	19⅔	81	64	68	.063	.099	.067	29.365	29.373	29.237	29.325
22	26	34	30	30	62	71	89	.088	.138	.148	28.953	28.891	28.949	28.931
23	23	25	17	21⅔	86	74	100	.106	.100	.098	29.073	29.059	29.060	29.064
24	32	39	35	35⅓	79	63	70	.143	.152	.142	28.916	28.881	28.849	28.882
25	28	40	19	29	88	56	69	.135	.139	.071	28.716	28.674	28.913	28.768
26	6	18	8	10⅔	100	84	77	.057	.082	.048	29.184	29.303	29.424	29.304
27	–3	20	17	11⅓	100	100	67	.038	.108	.063	29.436	29.343	29.174	29.318
28	25	39	38	34	87	91	100	.117	.216	.229	28.824	28.916	28.908	28.883
29	31	39	26	32	89	91	87	.155	.225	.123	28.790	28.669	28.899	28.786
30	28	33	30	30⅓	100	100	89	.153	.188	.148	29.047	29.136	29.213	29.132
31	24	35	35	31⅓	100	90	100	.129	.183	.204	29.260	29.189	29.154	29.201
Sums														
Means				19.19	90	80	87	.090	.109	.097				29.064
Average					86			.098						

JANUARY, 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per Cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	St.	100	Nim.	100	St.	s	8	s	6	s e	6	50	26	5 a. m.	3 p. m.	.10	----
100	St.	100	Nim.	100	Nim.	n w	6	n w	6	----	0	28	12	----	----	.06	¾
00	----	00	----	00	----	n w	2	----	0	----	0	25	12	----	----	----	----
100	Nim.	100	Nim.	100	St.	----	0	s w	4	s w	5	25	–5	In night.	8 p. m.	.14	2
100	St.	80	Cu. St.	20	Cir.	w	5	w	7	----	0	27	0	----	----	----	----
100	St.	100	St.	70	St.	----	0	n	3	----	0	27	10	----	----	----	----
90	St.	80	St.	100	Nim.	----	0	s w	8	s w	3	17	8	----	----	----	----
100	St.	100	Nim.	90	St.	----	0	----	0	----	0	21	-2	----	----	----	----
70	St.	10	St.	00	----	s w	4	s w	2	s w	1	10	–7	----	----	----	----
10	St.	90	St.	100	Nim.	s w	4	s w	3	----	0	16	–7	----	----	----	----
100	St.	100	Nim.	100	Nim.	n e	5	n e	3	n e	1	21	12	9 a. m.	10 p. m.	.35	3
100	St.	100	St.	100	St.	n	4	w	3	----	0	26	10	----	----	----	----
100	St.	100	St.	100	St.	n	5	n	3	n	2	20	11	snowy.	----	----	----
100	St.	30	Cir. Cu.	00	----	n w	4	w	4	w	1	23	–14	----	----	----	----
00	----	90	St.	50	St.	----	0	w	3	----	0	20	–13	----	----	----	----
30	St.	30	St.	20	St.	s e	1	s	7	s w	4	26	0	----	----	----	----
100	St.	100	St.	100	Nim.	s w	8	s w	8	s w	5	29	10	9 p. m.	----	----	----
100	Nim.	100	Nim.	100	Nim.	n e	1	n e	7	n e	1	14	1	----	In night.	.31	4¼
50	St.	00	----	00	----	n	2	n e	4	n e	4	20	–20	----	----	----	----
90	St.	80	St.	100	St.	----	0	----	0	----	0	17	1	----	----	----	----
00	----	00	----	00	----	----	0	s w	9	s w	7	29	12	----	----	----	----
100	St.	100	St.	100	St.	s w	11	s w	13	s w	11	34	23	----	----	----	----
100	St.	100	St.	00	----	n w	6	w	6	w	7	32	16	----	----	----	----
00	----	00	----	00	----	w	5	w	7	w	7	42	27	----	----	----	----
00	----	00	----	00	----	w	4	w	3	n e	5	41	5	----	----	----	----
30	Cir. Cu.	2	Cir. St.	00	----	n	5	n w	1	n	1	31	–10	----	----	----	----
90	Cir. St.	50	Cir. St.	00	----	n w	1	s w	1	s w	9	26	–3	----	----	----	----
1	Cir. St.	100	Cu. St.	100	Cu. St.	s w	8	s w	6	s w	11	39	25	----	----	----	----
2	Cu. St.	100	Cu. St.	00	----	s w	6	n	5	n	5	43	21	----	----	----	----
100	Cu. St.	100	Cu. St.	----	----	n	2	n w	1	----	0	33	18	----	----	----	----
30	Cu. St.	100	Cu. St.	100	St.	n w	11	s	9	n e	9	36	24	----	----	----	----
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	.96	10
64	----	69	----	55	----	----	----	----	----	----	----	27.32	6.55	----	----	----	----
		63				----	----	----	----	----	----	----	----	----	----	----	----

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity of per cent of saturation.			Pressure of vapor, in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	35	40	36	37	90	82	90	.183	.283	.191	29.134	29.021	29.046	29.067
2	37	39	31	35⅔	100	91	89	.221	.216	.155	28.827	28.827	29.068	28.907
3	30	33	31	31⅓	89	80	78	.148	.150	.136	29.224	29.153	29.247	29.208
4	27	31	27	28⅓	75	89	100	.111	.155	.147	29.281	29.183	29.193	29.219
5	20	33	23	25⅓	85	89	100	.091	.168	.123	29.174	29.243	29.325	29.247
6	20	36	18	24⅔	85	80	68	.091	.170	.067	29.301	29.177	29.143	29.207
7	34	46	37	39	89	84	71	.175	.241	.157	28.668	28.550	28.545	28.588
8	28	29	28	28⅓	88	77	88	.135	.123	.135	28.786	28.889	28.918	28.864
9	20	23	18	20⅓	85	72	84	.091	.089	.082	29.033	29.121	29.124	29.093
10	22	28	30	26⅔	71	100	89	.084	.153	.148	28.888	28.576	28.488	28.647
11	24	22	14	20	86	86	81	.111	.101	.067	28.511	28.655	28.791	28.652
12	8	17	1	8⅔	77	67	100	.048	.063	.046	28.861	28.930	28.963	28.918
13	8	21	18	15⅔	77	71	84	.048	.080	.082	28.953	28.796	28.698	28.816
14	23	24	21	22⅔	86	100	100	.106	.129	.113	28.681	28.550	28.740	28.657
15	12	14	4	10	100	81	100	.075	.067	.052	29.311	29.410	29.517	29.413
16	5	19	8	10⅔	74	69	100	.041	.071	.062	29.585	29.615	29.643	29.614
17	3	30	33	22	72	67	60	.036	.111	.113	29.597	29.435	29.282	29.438
18	27	31	25	27⅔	88	100	100	.129	.174	.135	29.237	29.229	29.149	29.215
19	21	30	28	26⅓	100	100	91	.113	.167	.208	29.137	29.069	29.150	29.119
20	28	35	32	31⅔	100	72	89	.153	.165	.162	29.237	29.293	29.359	29.296
21	30	36	34	33⅓	89	90	89	.148	.191	.175	29.503	29.477	29.492	29.491
22	34	39	36	36⅓	100	82	90	.196	.195	.191	29.536	29.505	29.503	29.514
23	31	35	32	32⅔	100	90	89	.174	.183	.162	29.487	29.442	29.222	29.384
24	31	43	39	37⅔	100	67	82	.174	.186	.195	29.303	29.244	29.154	29.234
25	34	35	34	34⅓	100	90	100	.196	.183	.196	29.092	29.121	29.206	29.139
26	28	34	23	28⅓	100	79	72	.153	.155	.089	29.411	29.527	29.622	29.520
27	21	37	28	28⅔	85	61	88	.096	.129	.135	29.637	29.527	29.492	29.552
28	31	42	38	37	100	74	91	.174	.199	.208	29.253	29.134	29.058	29.148
29	36	34	30	33⅓	90	100	100	.191	.196	.167	29.024	29.051	29.148	29.674
Sums														
Means				27.3	89	82	88	.127	.158	.134				29.133
Average						86			.139					

FEBRUARY, 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or rain.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow. inches.
90	St.	100	St.	100	St.	s	4	s w	2	n	1	42	24	1 a. m.			
100	Nim.	100	Nim.	100	St.	s	3	s w	7	n	1	37	24		5 p. m.	.51	
100	St.	70	Cu. St.	100	St.	n w	1	w	2	n w	1	35	24				
100	St.	100	St.	50	St.	n w	1	w	1	s e	4	34	18				
1	St.	00		00		n e	1	n e	1	n e	1	35	18				
70	Cu. St.	20	St.	20	St.	s	1	s	7	s e	5	36	18				
100	Nim.	100	Cu. St.	100	St.	n e	2	s w	9	s w	11	48	28	1 a. m.	3 p. m.	.15	15
100	St.	100	St.	100	St.	w	6	w	5	w	9	30	20				
100	Nim.	70	Cu. St.	30	St.	n w	5	w	7	w	4	26	14				
100	St.	100	Nim.	100	St.	s e	6	s e	5	s	2	32	20	11 a. m.	5 p. m.	.28	5
60	St.	100	St.	100	St.	n w	6	n e	6	w	6	30	6				
10	St.	100	St.	10	St.	n w	1	n w	3	s	1	22	—8				
100	St.	100	St.	10	St.	s e	7	s e	4	e	7	24	8				
100	St.	100	Nim.	90	St.	n e	1	n e	4	n w	4	25	12	10 a. m.	7 p. m.	.23	3
100	St.	30	Cu.	00		n	5	n w	7	w	1	25	—6				
100	St.	50	Cu.	00			0	w	6		0	24	—14				
00		90	Cu. St.	70	St.	s	1	s	7	s	8	34	3				
90	St.	100	Nim.	100	St.	s w	1	n e	1	n e	2	41	19	12 m.			
100	Nim.	100	Nim.	100	St.	n e	3	n e	2	n e	1	33	21		5 p. m.	.31	2
100	St.	100	St.	100	St.	n e	1	n e	1	n e	1	37	27				
100	St.	100	St.	100	St.	n e	1	n e	1	e	1	37	30				
100	St.	100	St.	100	St.	e	1		0		0	40	30				
100	Fog	100	St.	100	St.		0		0	e	2	37	30				
100	Fog	90	Cu. St.	100	St.	s e	2	s e	5	s e	7	44	29	In nig	ht	.25	
100	St.	100	St.	100	Nim.	s w	3	n	1	n	1	36	27				
00		100	Cu. St.	30	St.		0	n e	3	n e	4	43	18				
100	St.	10	St.	15	St.	n e	1	e	3	e	4	38	21				
100	St.	100	St.	100	Nim.	s e	6	s e	6	e	1	44	31	7 p. m.			14
100	Fog	100	Nim.	100	Nim.	e	1	n e	1	n e	5	36	22		9 p. m.	20½	
																1.93	10½
83		84		70								34.66	17.72				
		79															

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity or per cent of saturation.			Pressure of vapor, in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	23	31	20	24⅔	86	57	85	.106	.100	.091	29.389	29.412	29.439	29.413
2	15	35	27	25⅔	100	51	88	.086	.101	.129	29.445	29.425	29.403	29.424
3	26	45	42	37⅔	87	53	74	.123	.160	.199	29.385	29.230	29.169	29.261
4	33	34	31	32⅔	100	89	100	.188	.175	.174	29.126	29.097	29.081	29.101
5	29	34	29	30⅔	88	71	100	.142	.138	.160	29.085	29.117	29.159	29.120
6	25	40	31	32	86	56	89	111	.139	.155	29.205	29.185	29.159	29.183
7	28	46	40	38	100	41	73	.153	.125	.182	29.111	29.002	28.905	29.006
8	32	33	30	31⅔	100	100	100	.181	.188	.167	28.622	28.548	28 575	28.582
9	30	52	24	35⅓	89	53	86	.148	.208	.111	28.538	28.353	28.679	28.523
10	10	15	14	13	100	82	100	.068	.070	.082	28.726	28.847	29.019	28.864
11	18	25	24	22⅓	84	61	73	.082	.082	.094	29.158	29.166	29.085	29.136
12	36	44	32	37⅓	61	45	69	.129	.130	.125	28.846	28.964	29.085	28.965
13	16	24	18	19⅓	83	73	60	.074	.074	.061	29.265	29.263	29.373	29.300
14	10	22	17	16⅓	100	58	67	.068	.068	.863	29.539	29.475	29.437	29.484
15	12	25	18	18⅓	80	60	84	.060	.077	.082	29.471	29.420	29.409	29.433
16	11	26	19	18⅔	79	51	84	.057	.071	.087	29.494	29.447	29.463	29.468
17	13	24	17	18	100	60	100	.078	.077	.094	29.425	29.350	29.265	29.347
18	11	24	22	19	100	60	71	.071	.077	.084	29.163	29.088	29.047	29.099
19	23	25	22	23⅓	72	74	100	.089	.100	.118	28.806	28.766	28.955	28.842
20	12	29	22	21	80	53	71	.060	.082	.084	29.351	29.413	29.453	29.406
21	12	33	28	24⅓	80	50	53	.060	.095	.082	29.559	29.503	29.391	29.484
22	31	38	34	34⅓	100	100	100	.174	.229	.196	29.036	28.835	28.926	28.932
23	29	32	28	29⅔	88	79	88	.142	.143	.135	28.984	29.024	29.062	29.023
24	28	48	36	37⅓	88	70	80	.135	.236	.170	29.240	29.166	29.187	29.198
25	31	56	40	42⅓	89	40	73	.159	.179	.182	29.160	29.063	29.042	29.088
26	36	60	45	47	80	39	68	.170	.203	.204	28.849	28.702	28.655	28.735
27	34	46	36	38⅔	79	54	71	.155	.169	.149	28.724	28.919	29.091	28.911
28	30	46	36	37⅓	78	36	71	.130	.077	.149	29.290	29.336	29.343	29.323
29	27	52	43	40⅔	100	35	40	.147	.136	.076	29.404	29.382	29.295	29.360
30	36	39	39	38	61	91	82	.129	.216	.195	29.091	28.989	28.974	29.018
31	36	45	43	41⅓	100	84	92	.212	.251	.254	29.027	29.144	29.170	29.114
Sums														
Means				29.86	88	62	80	.119	.135	.133				29.121
Average						77			.129					

MARCH, 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Wind.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Cu. St.	10	Cn.	70	St.	n e	5	n e	4	n e	3	31	14				
00		10	Cir.	00		n e	1	e	1		0	36	14				
40	St.	70	Cu. St.	100	St.	s e	1	s	7	s	3	47	26				
100	St.	100	Nim.	100	St.		0	n e	1	n e	1	35	27	11 a. m.	4 p. m.	.18	1½
100	St.	100	St.	20	St.	n e	1	n	1		0	35	32				
90	St.	60	Cu. St.	..	Hazy		0	..	0		0	41	23				
40	Cir. Cu.	80	St.	100	St.		0		0		0	50	28				
100	Nim.	100	Nim.	60	Cir. Cu.	n e	1	n	3		0	36	27	In night	3 p. m.	.08	
90	Cu.	30	Cu.	100	St.	s e	1	s	8	w	7	53	10	3 p. m.	5 p. m.	.08	½
60	St.	80	Cu. St.	10	St.	s w	6	w	4	w	3	20	10				
100	St.	90	St.	100	St.	n w	6	w	7	s w	8	36	18				
100	St.	30	Cu.	100	St.	s w	8	n w	4	n e	2	44	14	In night	In night	.07	1
10	St.	100	St.	40	Cu. St.	n	5	n w	5	n	2	26	9				
00		40	Cu.	20	Cu.	n w	2	n w	1	n w	1	25	9				
5	St.	20	Cu.	00		n	6	w	5	w	3	28	9				
00		30	Cu.	00		n e	2	s w	1		0	29	11				
20	St.	100	St.	00		n e	1	n e	1		0	26	10				
10	St.	100	Cu. St.	100	St.	n	1	n w	2	n w	5	25	11				
100	Nim.	70	Cu. St.	20	St.	s w	7	w	5	n	4	30	10	7 a. m.	7 p. m.	.08	1
30	Cir. St.	20	Cu.	00		n w	1	n	1	n w	1	31	9				
00		10	St.	100	St.	n e	1	s	4	s e	5	36	12				
100	Nim.	100	Nim.	100	St.	s e	1	s	10	w	9	41	29	3 a. m.	5 p. m.	.42	1
100	St.	100	St.	00		w	5	w	6	w	6	34	26				
00		00		00		s w	8	s w	10		0	49	28				
10	St.	20	Cir. St.	20	St.		0	s	9		0	58	31				
00		40	Cir. St.	30	St.		0	e	6	n e	4	62	32				
100	Cu. St.	10	Cir. St.	40	St.	n e	5	n e	1	n e	1	48	25				
00		20	Cu.	00		n	1	n w	1		0	49	24				
00		20	Cir.	100	St.		0	e	2	e	5	54	27				
100	Cu. St.	100	Nim.	100	Nim.	e	3	e	4	e	1	43	36	1 p. m.			
100	Nim.	100	Cu. St.	00		n e	1	s e	8		0	51	36		8 a. m.	.40	
																1.31	5
52		57		46								39.00	19.90				
52																	

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor, in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	46	70	67	61	84	53	55	.262	.385	.362	29.129	28.927	28.838	28.985
2	57	64	55	58⅔	52	34	56	.242	.203	.243	28.780	28.891	28.991	28.887
3	46	64	54	54⅔	69	53	93	.215	.314	.390	29.113	29.013	28.991	29.039
4	58	66	66	63⅓	94	78	73	.452	.502	.470	28.795	28.801	28.697	28.764
5	60	56	42	52⅔	82	57	66	.310	.255	.177	28.683	28.724	28.877	28.761
6	37	49	45	43⅔	71	50	76	.557	.175	.228	29.183	29.152	29.099	29.145
7	42	64	48	51⅓	83	34	70	.222	.203	.276	29.014	28.932	28.962	28.989
8	40	43	31	38	82	51	78	.203	.142	.136	28.939	28.947	28.984	28.290
9	24	28	28	26⅔	86	76	88	.106	.117	.135	29.053	29.067	29.113	29.078
10	28	32	29	29⅔	76	79	88	.117	.143	.142	29.126	29.159	29.212	29.166
11	26	37	32	31⅔	87	81	79	.123	.178	.143	29.265	29.276	29.296	29.279
12	28	47	25	33⅓	88	33	87	.135	.103	.117	29.465	29.463	29.467	29.465
13	27	48	38	37⅔	100	43	72	.147	.143	.165	29.475	29.406	29.467	29.449
14	33	42	32	35⅔	89	60	58	.168	.232	.106	28.974	29.979	29.119	29.024
15	29	50	36	38⅓	88	32	61	.142	.117	.129	29.207	29.183	29.151	29.180
16	38	54	38	43⅓	45	15	81	.103	.065	.186	29.163	29.027	29.025	29.072
17	37	49	42	42⅔	81	37	50	.178	.130	.134	29.044	29.021	29.019	29.028
18	36	52	34	40⅔	64	23	61	.129	.091	.120	29.027	29.163	29.260	29.150
19	34	51	37	40⅔	71	40	62	.138	.149	.136	29.469	29.463	29.506	29.379
20	39	56	50	48⅓	55	29	39	.131	.131	.139	29.436	29.264	29.226	29.309
21	40	52	47	46⅓	100	79	92	.248	.308	.298	28.919	28.876	28.931	28.908
22	42	44	40	42	74	76	82	.199	.218	.203	28.921	28.945	28.957	28.941
23	39	63	40	47⅓	91	33	31	.216	.189	.077	29.014	29.002	29.217	29.078
24	32	45	34	37	69	32	79	.125	.095	.155	29.460	29.439	29.483	29.461
25	29	50	38	39	77	32	63	.123	.117	.144	29.577	29.534	29.512	29.474
26	36	56	49	47⅓	45	29	44	.096	.131	.152	29.560	29.507	29.449	29.172
27	48	68	70	62	49	47	66	.165	.319	.482	29.251	29.037	28.891	29.393
28	54	52	45	50⅓	74	60	53	.308	.232	.160	28.960	29.041	29.117	29.039
29	39	58	42	46⅓	63	22	66	.152	.104	.177	29.276	29.292	29.353	29.307
30	38	56	49	47⅔	72	40	64	.165	.179	.223	29.483	29.357	29.232	29.391
Sums.														
Means				44.5	75	47	68	.196	.209	.200				29.107
Average					63			.202						

APRIL, 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
80	St.	70	St.	100	Nim.	s e	5	s e	3	s	5	72	51				
5	Cu.	10	Cu.	10	Cir.	s w	50	s w	25	w	9	66	42				
10	Cir.	100	St.	100	Nim.		0	s	7	w	4	64	46	4 p. m.			
100	Nim.	100	Cu. St.	100	Nim.	s	6	s w	8	s	7	70	52		12 p. m.	.77	
10	Cu.	80	Cu.	100	Cu. St.	s	9	s w	5	s w	1	65	37	8 a. m.	9 a. m.	.13	
100	St.	00		30	St.	n w	1	s w	1	w	1	53	37				
20	St.	50	Cir. St.	10	St.	s w	1	w	6	w	1	66	35				
100	St.	100	Cu. St.	100	St.	w	3	n w	3	w	2	47	21				
100	Nim.	100	Cu. St.	100	St.	n w	4	n w	3	n w	4	29	23				
60	Cu.	100	Cu. St.	90	St.	n w	2	n w	2	n w	3	33	20				
10	St.	80	Cu.	10	St.	n	1	n w	2	w	1	41	22				
00		00		00		n w	1	n w	1	n	1	48	22				
10	St.		Hazy.	100	St.	e	1	e	2	e	2	50	27				
100	Nim.	80	Cu. St.	00		n e	1	n	20	n	12	45	26	5 a. m.	9 a. m.	.09	1
00		20	Cu.	00			0	n w	2	s w	1	54	30				
80	Cu.	20	Cu.	00		n w	1	n	5	n w	1	54	34				
100	Cu. St.	80	Cu. St.	00		n	1	e	7	s	5	53	28				
80	Cu. St.	20	Cu. St.	10	St.	n w	5	n w	1	n	3	52	27				
10	St.	20	Cu.	20	St.	n e	2	n e	18	n e	15	53	30				
	Hazy.	70	Cu. St.	50	St.	n e	12	e	15	e	6	60	39				
100	Nim.	100	Cu. St.	100	Nim.	e	7	s w	8	w	4	59	39	12 m.	10 a. m.	.50	
100	Cu. St.	100	Cu. St.	00		w	5	w	6	w	3	49	33				
00		00		90	St.	s w	3	w	12	n	10	64	24				
30	St.	10	St.	20	St.	n e	7	n e	5	e	5	46	23				
5	Cir.	10	Cir.	10	St.	e	4	n e	5	n	4	52	27				
10	Cir.	20	Cir.	40	St.	e	2	s e	5	s	6	60	37				
50	Cir. St.	100	Cu. St.	100	Nim.	s e	8	s e	10	s	5	73	49	8 p. m.	12 m.	.55	
100	St.	70	Cu. St.	10	St.	s w	5	w	25	w	5	55	32				
00		00		20	St.	n	2	n w	8	n w	3	58	32				
40	Cir.	90	Cu. St.	100	Nim.	e	4	s	10	s w	4	57	38				
																2.04	1
49		55		47								54.93	32.77				
		50															

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.				Relative humidity or per cent of saturation.			Pressure of vapor in inches.			Barometer, reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M	9 P. M.	7 A. M.	2 P. M.	9 P. M,	Mean.
1	50	69	62	60⅓	93	70	88	.335	.496	.491	28.994	28.931	28.929	28.951
2	55	57	52	54⅓	94	87	93	.405	.407	.361	28.839	28.931	28.945	28.905
3	60	72	68	66⅔	100	66	65	.537	.524	.443	28.788	28.823	28.841	28.817
4	45	58	52	51⅔	76	53	73	.228	.255	.282	29.202	29.239	29.317	29.253
5	43	44	42	43	92	100	100	.254	.289	.267	29.214	29.143	29.104	29.153
6	51	60	48	53	100	65	92	.374	.323	.310	29.009	29.094	29.153	29.085
7	43	44	36	41	92	68	90	.354	.196	.191	29.271	29.337	29.372	29.327
8	41	50	40	43⅔	65	64	82	.169	.223	.203	29.483	29.472	29.503	29.486
9	45	62	53	53⅓	61	51	67	.182	.284	.269	29.471	29.373	29.233	29.359
10	46	52	52	50	100	93	93	.311	.361	.361	28.969	28.843	28.771	28.861
11	48	48	44	48⅔	92	92	100	.310	.310	.289	28.730	28.719	28.807	28.752
12	44	58	51	51	92	58	79	.265	.282	.296	28 976	29.133	29.203	29.104
13	49	59	51	53	85	59	93	.297	.296	.348	29.282	29.242	29.212	29.245
14	53	63	57	57⅔	86	72	87	.348	.416	.407	29.192	29.155	29.105	29.151
15	56	63	57	58⅔	87	94	75	.391	.543	.350	29.083	28.919	29.019	29.007
16	53	64	54	57	73	53	87	.295	.314	.362	29.247	29.243	29.253	29.248
17	59	71	61	63⅔	70	45	61	.352	.340	.325	29.286	29.249	29.150	29.228
18	60	63	60	61	60	77	94	.310	.446	.487	28.935	28.769	28.691	28.798
19	54	57	45	52	87	58	92	.362	.268	.275	28.412	28.402	28.503	28.442
20	43	51	43	45⅔	67	59	92	.186	.221	.254	28.734	28.881	28.995	28.870
21	49	46	45	46⅔	71	92	84	.247	.286	.251	29.039	29.059	29 075	29.058
22	47	53	44	48	77	67	84	.249	.269	.241	29.059	29.024	29.033	29.039
23	49	58	50	52⅓	71	58	71	.247	.282	.258	28.977	28.965	28.943	28.962
24	52	63	55	56⅔	53	42	94	.208	.243	.405	28.959	28.908	28.870	28.942
25	53	68	58	59⅔	81	47	76	.349	.319	.365	28 893	28.847	28.868	28.869
26	50	61	49	53⅓	85	50	85	.309	.269	.297	28.883	28.720	28.805	28.803
27	49	56	50	51⅔	78	57	71	.272	.255	.258	28.919	29.004	28.992	28.972
28	45	64	58	55⅔	87	48	76	.376	.285	.365	29.024	28.933	28.775	28.911
29	58	70	60	62⅔	64	44	71	.309	.323	.367	28.670	78.812	28.897	28.793
30	66	78	61	68⅓	59	57	94	.376	.527	.505	28.985	29.017	29.021	29.008
31	65	77	65	69	89	61	94	.549	.564	.583	29.124	29.035	29.206	29.122
Sums														
Means				54.5	80	65	84	.315	.346	.306				29.003
Average					76			.322						

MAY, 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Nim.	80	Cu.	100	St.	s	7	s w	6	----	00	72	50	12 p. m.	--------	.45	------
100	Nim.	100	St.	100	St.	n e	2	---	0	n e	6	61	51	--------	--------	.55	------
100	Nim.	100	Nim.	10	Cu.	s w	5	s w	8	s w	16	75	45	6 a. m.	3 p. m.	.30	------
80	Cu. St.	20	Cu.	100	St.	n w	8	n w	5	n w	3	61	42	12 p. m.	--------	------	------
100	Nim.	100	Cu.	100	Nim.	e	9	e	5	s e	6	52	41	--------	12 a. m.	1.10	------
100	St.	70	Cu.	10	St.	s w	6	w	13	w	3	61	42	--------	--------	------	------
100	St.	100	St.	10	Cir.	n w	7	n e	4	n e	1	45	31	--------	--------	------	------
00	--------	80	Cu.	100	St.	n e	6	n e	7	n e	2	54	35	--------	--------	------	------
70	St.	100	Cir. St.	100	St.	e	5	e	12	n e	6	63	45	--------	--------	------	------
100	Nim.	100	Nim.	100	Nim.	e	8	e	2	w	7	64	46	In night	--------	.73	------
100	Nim.	100	Nim.	100	Nim.	w	10	s w	13	w	3	51	41	--------	10 p. m.	.25	------
100	Nim.	30	Cu.	10	St.	n	5	n e	6	----	0	60	39	--------	--------	------	------
50	St.	100	St.	20	St.	n e	2	s e	1	s e	1	60	49	--------	--------	------	------
100	St.	100	St.	100	St.	e	1	e	1	----	0	65	52	--------	--------	------	------
100	St.	100	Nim.	90	Cu. St.	s	10	s w	13	n w	9	66	42	10 a. m.	4 p. m.	.25	------
40	Cu. St.	90	Cu.	00	--------	s w	7	w	10	----	0	69	44	--------	--------	------	------
10	St.	80	Cir. Cu.	50	St.	---	0	s e	9	e	8	75	57	--------	--------	------	------
100	Cu. St.	100	Nim.	100	Nim.	s e	14	e	14	e	11	65	52	9 a. m.	12 p. m.	.75	------
80	Cu. St.	80	Cu. St.	100	Cu. St.	s	11	s	10	s	1	58	39	--------	--------	------	------
100	Cu. St.	100	Cir. St.	00	--------	s w	1	w	1	----	0	55	38	--------	--------	------	------
40	Cu.	100	Nim.	100	Nim.	n w	1	n w	1	n e	1	55	40	--------	--------	------	------
40	Cu.	90	Cu.	00	--------	n	1	n e	7	----	0	53	43	--------	--------	------	------
100	St.	40	Cu.	20	St.	n w	5	e	5	---	0	62	44	--------	--------	------	------
80	St.	100	Cu. St.	100	Nim.	s w	10	s w	13	s w	7	64	50	4 p. m.	In night	.44	------
30	Cir. St.	70	Cu.	20	St.	s w	5	s w	12	w	4	70	48	--------	--------	------	------
100	St.	60	Cu.	00	--------	s w	6	w	8	----	0	64	44	--------	--------	------	------
70	Cu.	90	Cu.	00	--------	n	6	n e	8	----	0	63	38	--------	--------	------	------
00	--------	20	Cu.	40	St.	s w	4	s	11	s	10	66	45	In night	In night	.10	------
100	Nim.	10	Cu.	20	St.	w	11	w	9	----	0	72	58	--------	--------	------	------
10	St.	90	Cu. St.	100	Nim.	s w	9	s w	5	e	5	78	61	4 p. m.	10 p. m.	.20	------
100	St.	40	Cu.	100	Nim.	s w	6	s w	7	s	7	80	65	4 p. m.	12 p. m.	.80	------
----	--------	----	--------	----	--------						----	------	------	--------	--------	5.92	------
74	--------	79	--------	58	--------	----	----	----	----	----	----	63.19	45.71	--------	--------	------	------
70						----	----	----	----	----	----	------	------	--------	--------	------	------

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	69	72	70	70⅓	85	81	90	.599	.631	.658	29.061	29.086	29.006	29.051
2	69	71	56	65⅓	85	80	94	.599	.608	.420	29.003	29.006	29.101	29.036
3	53	59	58	56⅔	100	100	100	.433	.500	.483	29.173	29.159	29.165	29.166
4	55	66	65	62	100	94	100	.433	.604	.618	29 199	29.164	29.156	29.173
5	63	72	61	65⅓	94	88	81	.543	.473	.631	29.179	29.159	29.142	29.160
6	61	78	67	68⅔	88	61	79	.473	.564	.522	29.160	29.123	29.081	29.121
7	62	72	64	66	94	72	83	.523	.559	.497	29.105	29.091	29.069	29.188
8	61	24	62	65⅔	88	67	94	.473	.568	.523	29.055	29.963	28.947	28.988
9	61	66	63	63⅓	94	84	94	.505	.536	.543	28.973	28.979	28.997	28.983
10	61	78	63	67⅓	94	56	83	.505	.505	.478	29.089	29.103	29.097	29.096
11	65	81	72	72⅔	78	59	81	.483	.624	.631	29.107	29.046	29.026	29.059
12	76	86	76	79⅓	73	65	77	.652	.805	.691	29.077	29.080	29.075	29.077
13	74	84	70	76	81	68	85	.680	.789	.621	29.090	29.075	29.026	29.064
14	65	75	65	68⅓	89	68	94	.529	.591	.583	29.015	29.053	29.099	29.056
15	65	81	71	72⅓	89	90	86	.549	.658	.644	29.111	29.054	29.003	29.056
16	70	85	73	76	85	50	72	.621	.610	.581	29.036	29.055	29.057	29.049
17	68	80	69	72⅓	100	70	95	.662	.717	.671	29.189	29.007	29.214	29.137
18	66	71	68	68⅓	100	100	95	.639	.759	.648	29 209	29.086	29.051	29.115
19	70	74	65	69⅔	90	90	73	.658	.758	.451	28.911	28.850	28.886	28.882
20	68	80	67	71⅔	90	70	95	.612	.717	.626	28.836	28.807	28.856	26.833
21	71	77	67	71⅔	90	69	95	.682	.637	.626	28.826	28.807	28.836	28.823
22	65	74	68	69	89	67	95	.549	.568	.648	28.951	28.920	28.911	28.927
23	69	75	68	70⅔	90	81	95	.635	.705	.648	28.921	28.957	29.007	28.962
24	65	76	68	69⅔	100	73	90	.618	.652	.612	29.091	29.057	29.107	29.085
25	60	68	61	63	76	65	88	.396	.443	.473	29.262	29.225	29.203	29.230
26	61	72	61	64⅔	83	54	95	.442	.422	.505	29.196	29.111	29.001	29.103
27	64	60	54	59⅓	94	88	93	.563	.456	.390	28.605	28.609	28.896	28.103
28	58	71	59	62⅔	70	54	88	.337	.403	.439	28.783	28.811	28.896	28.830
29	60	69	60	63	88	61	88	.456	.430	.456	28.912	28.921	28.951	28.928
30	59	65	51	58⅓	100	44	79	.500	.272	.296	29.003	29.075	29.175	29.084
Sums														
Means				67.7	89	72	89	.544	.585	.553				29.019
Average						83			.561					

JUNE, 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
90	Cu. St.	100	Cu. St.	50	Cu. St.	s w	10	s w	8	s	9	76	65	5 p. m.	7 p. m.	.06	.06
10	Cu. St.	100	Cu. St.	100	Nim.	s w	9	s w	3	n e	6	72	54	2 p. m.	--------	.47	------
100	Nim.	100	St.	100	St.	e	5	e	4	e	3	60	52	--------	--------	.17	------
100	St.	100	Cu. St.	100	Cu. St.	e	2	s e	1	s e	1	66	53	--------	--------	.42	------
90	St.	90	St.	30	Cu.	e	5	s e	2	w	1	72	59	--------	10 p. m.	.30	------
00	--------	20	Cu.	100	St.	----	0	s	5	e	1	79	60	--------	--------	------	------
100	Cu. St.	100	Cu. St.	30	Cir.	e	5	s e	8	s e	7	73	58	2 a. m.	10 a. m.	.32	.31
100	St.	70	Cu.	90	Cu.	s	6	s	9	----	0	76	57	-------	--------	------	------
100	St.	100	St.	00	--------	n w	3	n w	3	n	2	70	58	--------	--------	------	------
100	St.	30	Cu.	00	--------	n e	3	s	8	----	0	79	55	--------	--------	------	------
00	--------	30	Cu.	00	--------	s e	4	s	9	s	1	81	65	--------	--------	------	------
20	Cu.	20	Cu.	00	--------	s w	5	s w	7	----	0	87	68	--------	--------	------	------
00	--------	80	Cu. St.	00	--------	s w	7	s w	8	s w	4	86	60	3 p. m.	5 p. m.	.06	------
90	Cu. St.	30	Cu.	00	--------	w	7	n w	5	----	0	76	58	--------	--------	------	------
00	--------	40	Cu.	00	--------	s	5	s w	6	----	0	81	65	--------	--------	------	------
100	St.	10	Cu.	100	Nim.	----	0	n w	5	n w	2	87	62	9 p. m.	12 p. m.	.37	.37
100	Cu. St.	40	Cu.	50	St.	----	0	e	1	n e	1	81	65	--------	--------	------	------
100	St.	100	Nim.	100	St.	s e	1	s e	1	s	4	74	66	11 a. m.	3 p. m.	.22	------
100	St.	100	Cu. St.	10	St.	s	3	n	6	w	4	78	65	11 a. m.	3 p. m.	.33	.3
80	St.	40	Cu.	10	Cu.	s w	4	w	10	w	1	81	63	--------	--------	------	------
70	Cu. St.	60	Cu. St.	10	Cu.	s w	6	n w	7	----	0	80	65	Showers.	Showers.	.03	------
100	St.	100	Nim.	100	St.	s w	4	s	2	----	0	78	65	2 p. m.	11 p. m.	.50	.32
80	St.	90	St.	100	St.	w	4	w	6	----	0	77	61	--------	--------	------	------
100	St.	80	Cu.	50	St.	----	0	n w	4	n	3	77	54	--------	--------	------	------
40	Cir. St.	50	Cu.	00	--------	n w	5	n	2	----	0	71	53	--------	--------	------	------
20	Cir.	90	Cu. St.	100	Nim.	n	2	s e	3	s e	7	74	59	4 p. m.	--------	------	.95
40	Cu.	100	Cu. St.	100	Nim.	s w	7	s w	10	w	10	68	52	--------	4 a. m.	.96	------
00	--------	50	Cu.	00	--------	w	7	w	10	w	2	72	55	In night.	In night.	.12	------
20	Cir.	90	Cu. St.	00	--------	s w	6	w	12	w	5	70	57	--------	--------	------	------
90	Cu. St.	40	Cu.	00	--------	n w	3	w	11	----	0	69	42	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	4.33	------
66	--------	68	--------	44	--------	----	----	----	----	----	----	75.70	59.03	--------	--------	------	------
			59			----	----	----	----	----	----	------	------	--------	--------	------	------

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.				Relative humidity or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	53	66	57	58⅔	86	49	81	.348	.316	.378	29.247	29.203	29.163	29.204
2	57	56	55	56	81	100	100	.378	.449	.433	29.110	28.935	28.853	28.966
3	54	63	57	51⅓	100	67	94	.418	.386	.436	28.908	29.045	29.155	29.036
4	55	71	58	61⅓	74	45	88	.321	.340	.423	29.303	29.292	29.317	29.304
5	61	72	57	63⅓	71	46	81	.383	.358	.378	29.392	29.419	29.442	29.418
6	59	75	62	65⅓	76	44	88	.380	.382	.491	29.562	29.553	29.662	29.592
7	63	76	62	67	83	41	72	.478	.369	.399	29.719	29.564	29.533	29.604
8	60	79	65	68	82	57	94	.326	.574	.583	29.439	29.375	29.328	29.381
9	65	82	68	71⅔	89	45	90	.549	.497	.612	29.305	29.254	29.229	29.283
10	71	81	71	74⅓	86	56	90	.644	.585	.682	29.266	29.231	29.234	29.244
11	68	81	69	76	85	52	90	.577	.547	.635	29.229	29.194	29.154	29.192
12	70	82	73	78⅓	85	56	90	.621	.610	.732	29.134	29.064	29.017	29.072
13	70	81	69	73⅛	85	64	85	.621	.670	.621	29.003	29.016	29.076	29.032
14	67	79	69	71⅔	78	51	90	.502	.501	.635	29.159	29.095	29.086	29.113
15	69	79	57	68⅓	85	69	69	.599	.691	.322	28.971	28.904	29.121	28 999
16	55	68	59	60⅔	74	51	76	.321	.349	.380	29.309	29.315	29.293	29 306
17	62	76	60	66	72	49	77	.399	.436	.464	29.338	29.289	29.253	29.301
18	64	78	60	67⅓	77	43	94	.464	.409	.487	29.243	29.157	29.173	29.191
19	65	80	72	72⅓	100	37	86	.618	.382	.668	29.144	29.147	29.145	29.175
20	69	84	69	74	90	40	70	.635	.470	.496	29.244	29.214	29.214	29.224
21	65	84	74	74⅓	68	43	81	.420	.507	.680	29.272	29.146	29.138	29.165
22	72	88	74	78	86	46	90	.668	.609	.758	29.126	29.111	29.095	29.077
23	68	90	78	78⅔	95	47	69	.648	.665	.664	29.116	29.090	29.074	29.093
24	83	91	75	83	75	57	81	.846	.827	.705	29.025	29.036	29.105	29.055
25	75	93	82	83⅓	86	42	75	.745	.638	.816	29.107	29.086	29,085	29.092
26	78	93	78	83	82	46	82	.785	.710	.785	29.157	29.108	29.106	29.123
27	76	80	78	78	86	74	78	.772	.758	.744	29.125	29.044	29.018	29.062
28	76	89	76	80⅓	81	50	81	.731	.678	.731	29.079	29.042	29.057	29.059
29	72	61	60	64⅓	95	88	38	.745	.473	.456	29.066	29.172	29.233	29.157
30	62	74	64	66⅔	83	56	77	.460	.463	.464	29.253	29.254	29.206	29.238
31	65	77	64	68⅔	78	35	89	.483	.323	.529	29.198	29.175	29.115	29.163
Sums														
Means				70.29	83	53	84	.537	.515	.566				29.178
Average						73			.539					

JULY, 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering Thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
00	--------	90	Cu.	100	St.	n w	4	s w	6	----	0	68	48	--------	--------	------	------
100	St.	100	Nim.	100	Nim.	s	6	s e	8	s e	2	61	53	11 a. m.	--------	------	------
100	Nim.	50	Cu.	30	Cu.	n e	5	n	6	----	0	68	45	--------	10 a. m.	.96	------
10	Cir.	10	Cu.	30	Cu.	---	0	s w	3	n	1	73	48	--------	--------	------	------
00	--------	15	Cu.	00	--------	n	2	n e	4	---	0	75	48	--------	--------	------	------
00	--------	00	--------	00	--------	----	0	e	4	----	0	77	52	--------	--------	------	------
00	--------	20	Cir.	00	--------	--	0	e	7	e	3	79	51	--------	--------	------	------
00	--------	70	Cu.	20	Cu.	e	1	e	1	e	1	81	59	--------	--------	------	------
80	Cir. Cu.	40	Cu.	10	St.	e	1	s e	4	----	0	83	59	--------	--------	------	------
00	--------	60	Cu.	10	St.	s w	1	s w	1	----	0	83	61	--------	--------	------	------
40	Cir. Cu.	80	Cir. Cu.	00	--------	s w	1	s w	4	---	0	84	62	--------	--------	------	------
00	--------	90	Cu. St.	20	St.	s w	5	s w	5	----	0	83	65	In night.	--------	.03	------
40	Cir. St.	40	Cu.	00	--------	n w	1	n	4	----	0	83	57	--------	--------	------	------
10	St.	10	Cu.	00	--------	n e	2	n	4	----	0	82	64	--------	--------	------	------
90	St.	90	Cu. St.	50	St.	s	5	s w	14	n	7	85	45	--------	--------	------	------
00	--------	70	Cu.	00	--------	n	5	n e	4	---	0	72	47	--------	--------	------	------
00	--------	40	Cu.	00	--------	s w	3	n w	6	----	0	78	53	--------	--------	------	------
10	St.	50	Cu. St.	100	St.	w	3	s w	10	s w	2	79	63	Sprinkle	--------	.01	------
100	St.	30	Cir. St.	00	--------	s w	4	s w	8	---	0	82	62	--------	--------	------	------
20	Cu.	20	Cu.	00	--------	n w	1	n w	3	w	2	86	55	--------	--------	------	------
40	St.	10	Cu.	00	--------	s	1	s w	6	----	0	86	64	--------	--------	------	------
30	Cir. Cu.	30	Cu.	00	--------	----	0	s w	9	----	0	90	62	--------	--------	------	------
100	Fog.	15	Cu.	00	----	----	0	s	7	----	0	92	67	--------	--------	------	------
00	--------	30	Cu.	60	Cir. Cu.	s w	7	s w	9	n w	1	92	67	--------	--------	------	------
00	--------	30	Cu.	10	Cu.	s w	6	s w	13	----	0	93	73	--------	--------	------	------
00	--------	40	Cu.	20	Cir. St.	s w	3	s w	7	e	2	95	71	--------	--------	------	------
00	--------	100	Cu. St.	50	Cu. St.	s w	6	s w	9	----	0	91	72	--------	--------	------	------
00	--------	30	Cu.	40	Cu. St.	s w	6	s w	12	----	0	90	69	10 p. m.	--------	------	------
100	Nim.	100	Nim.	00	--------	n	4	n	5	n	1	77	52	--------	2 p. m.	.100	------
00	--------	20	Cir. Cu.	00	--------	n	2	n	4	n	1	78	53	--------	--------	------	------
00	--------	00	--------	20	Cir. St.	n	2	w	5	w	1	80	58	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	2.00	------
28	--------	45	--------	22	--------	----	----	----	----	----	----	81.48	58.23	--------	--------	------	------
32						----	----	----	----	----	----	------	------	--------	--------	------	------

METEOROLOGICAL OBSERVATIONS FOR THE MONTH

Day of month.	Thermometer in open air.				Relative humidity, or per cent of saturation.			Pressure of vapor, in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	63	68	64	65	88	85	94	.510	.577	.563	29.153	29.169	29.145	29.156
2	60	75	64	66⅓	100	52	94	.500	.449	.563	29.188	29.151	29.138	29.159
3	62	82	68	70⅔	83	52	95	.460	.572	.648	29.125	29.174	29.071	29.123
4	57	72	64	64⅓	81	50	77	.378	.390	.464	29.183	29.204	29.156	29.181
5	61	72	65	66	88	66	94	.473	.524	.583	29.128	28.961	28.985	29.025
6	62	78	64	68	88	58	94	.491	.550	.563	29.089	29.107	29.129	29.108
7	69	80	70	73	65	55	70	.462	.561	.516	29.175	29.079	29.106	29.120
8	68	80	80	76	90	55	74	.612	.561	.758	29.041	28.964	28.914	28.973
9	77	90	75	80⅔	86	53	86	.799	.751	.745	28.949	28.932	28.932	28.938
10	73	80	72	75	90	70	95	.732	.717	.745	28.947	28.884	28.985	28.939
11	68	75	66	69⅔	95	73	89	.648	.628	.570	29.047	29.007	29.175	29.106
12	60	74	61	65	88	48	77	.456	.396	.413	29.332	29.304	29.275	29.304
13	56	74	62	64	87	56	83	.391	.463	.460	29.282	29.214	29.212	29.236
14	67	79	67	70	69	40	77	.457	.396	.516	29.198	29.132	29.148	29.157
15	66	89	68	74⅓	84	29	69	.536	.403	.476	29.222	29.202	29.218	29.214
16	68	83	67	72⅔	75	41	89	.509	.454	.591	29.239	29.204	29.187	29.210
17	75	85	69	76⅓	60	38	90	.519	.456	.635	29.195	29.173	29.187	29.185
18	76	86	74	78⅔	60	45	77	.541	.557	.641	29.152	29.157	29.188	29.166
19	64	70	58	64	77	48	88	.464	.353	.423	29.176	29.194	29.406	29.259
20	58	72	55	61⅔	37	42	87	.178	.327	.376	29.174	29.111	29.261	29.182
21	60	79	63	67⅓	82	35	88	.426	.248	.510	29.105	29.184	29.309	29.199
22	61	74	64	66⅓	88	56	94	.473	.463	.563	29.178	29.174	29.326	29.226
23	70	81	65	72	75	35	94	.551	.369	.583	29.162	29.084	29.105	29.117
24	65	69	64	66	89	100	100	.549	.708	.596	29.041	28.956	29.008	29.002
25	64	63	66	64⅓	100	100	100	.596	.576	.639	28.916	28.916	29.122	28.985
26	60	72	64	65⅓	77	53	94	.464	.455	.563	29.127	29.144	29.226	29.166
27	61	67	66	64⅔	88	89	89	.473	.591	.570	29.198	29.164	29.179	29.160
28	63	70	59	64	83	70	79	.478	.516	.564	29.188	29.181	29.138	29.169
29	63	77	70	70	83	73	70	.478	.678	.516	29.117	29.095	28.976	29.056
30	73	64	55	64	77	73	100	.617	.433	.423	28.883	28.891	28.968	28.914
31	53	56	52	53⅔	80	75	73	.321	.336	.282	29.034	29.106	29.223	29.121
Sums														
Means				68.3	81	59	86	.514	.499	.550				29.111
Average						75			.521					

AUGUST 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermom'r.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Cu. St.	100	Cu. St.	100	Cu. St.	w	2	w	3	n e	3	72	56	8 a. m.	1 a. m.	.24	------
100	Fog	30	Cu.	00	--------	----	0	n	3	----	0	77	55	--------	--------	------	------
10	Cu.	50	Cu.	100	Nim.	w	5	s w	9	----	0	82	54	5 p. m.	9 p. m.	2.28	------
00	--------	30	Cir. St.	00	--------	n	4	n e	3	----	0	74	55	--------	--------	------	------
100	Cu. St.	100	Cu. St.	00	--------	s w	4	s w	11	s w	3	74	58	--------	--------	------	------
00	--------	10	Cir.	00	--------	----	0	n w	3	----	0	81	57	--------	--------	------	------
00	--------	30	Cu. St.	30	St.	n	2	s w	5	s	6	83	63	--------	--------	------	------
20	Cir.	100	Cu. St.	40	Cir. Cu.	s w	4	s	5	s w	8	86	68	--------	--------	------	------
20	Cir. Cu.	20	Cir.	10	Cu.	s w	7	s w	10	s w	3	90	73	--------	--------	------	------
100	Cu. St.	40	Cu.	50	Cu. St.	s w	9	s w	8	s w	3	82	67	3 p. m.	12 p. m.	.64	------
100	Cu. St.	100	Cu. St.	10	Cu.	s w	5	n	4	n	1	78	57	--------	--------	------	------
00	--------	00	--------	00	--------	n	2	n e	4	n e	1	76	49	--------	--------	------	------
00	--------	40	Cu.	00	--------	n e	1	n e	2	----	0	78	56	--------	--------	------	------
10	Cir. Cu.	00	--------	----	--------	s w	4	s w	6	----	0	80	59	--------	--------	------	------
00	--------	5	Cu.	00	--------	----	0	n w	2	n e	1	89	59	--------	--------	------	------
00	--------	15	Cu.	00	--------	----	0	n e	2	n e	1	88	63	--------	--------	------	------
00	--------	00	--------	00	--------	s w	1	s w	4	----	0	88	65	--------	--------	------	------
00	--------	20	Cir.	00	--------	s w	2	s w	10	----	0	88	64	--------	--------	------	------
100	Cu. St.	00	--------	00	--------	n e	3	n e	4	n e	1	73	45	--------	--------	------	------
00	--------	00	--------	00	--------	n e	1	n e	2	n e	1	72	52	--------	--------	------	------
100	Cu. St.	10	Cir.	00	--------	----	0	n e	2	----	0	80	54	--------	--------	------	------
85	Cu.	90	Cir.	00	--------	----	0	n	3	n e	3	78	58	--------	--------	------	------
00	--------	60	Cu.	----	--------	s e	4	s	5	n e	3	86	60	--------	--------	------	------
100	Cu. St.	100	Cu. St.	100	Cu. St.	n e	2	n e	6	n e	4	77	63	1 p. m.	11 p. m.	1.20	------
100	Cu. St.	100	Cu. St.	----	--------	n e	4	n e	5	----	3	77	55	12.30 p m	2 p. m.	.60	------
00	--------	00	--------	00	--------	n e	1	n e	1	n e	1	72	53	--------	--------	------	------
95	Cir. Cu.	90	Cu.	00	--------	n e	1	n e	2	----	0	73	58	--------	--------	------	------
10	Cir. St.	50	Cu.	00	--------	----	0	e	5	e	2	80	55	--------	--------	------	------
50	Cu. St.	100	Cu.	10	Cir. St.	e	4	s	6	s e	6	83	64	--------	--------	------	------
100	Cu. St.	60	Cu.	100	Nim.	s	8	w	14	s w	6	73	50	8.30 a.m.	9.30 a.m.	.11	------
20	Cir. Cu.	100	Cu. St.	100	St.	w	1	n w	8	e	2	56	49	In	night.	.05	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	5.12	------
43	--------	47	--------	21	--------	----	----	----	----	----	----	78.74	57.87	--------	--------	------	------
		37				----	----	----	----	----	----	-----	------	--------	--------	------	------

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer, in open air.				Relative humidity or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	51	63	50	54⅔	72	47	85	.270	.270	.309	29.317	29.312	29.309	29.312
2	54	72	60	62	74	46	76	.308	.358	.396	29.357	29.289	29.280	29.302
3	57	77	62	65⅓	87	49	83	.407	.457	.460	29.263	29.195	29.132	29.197
4	69	82	72	74⅓	75	45	81	.529	.497	.631	29.124	29.036	29.015	29.058
5	56	66	49	57	94	68	85	.420	.438	.297	29.042	29.031	29.169	29.081
6	50	62	50	54	93	56	93	.335	.312	.335	29.262	29.246	29.246	29.251
7	52	58	49	53	79	64	92	.308	.309	.322	29.292	29.287	29.344	29.304
8	51	66	57	58	93	68	87	.348	.438	.407	29.384	29.384	29.356	29 375
9	59	76	63	66	82	56	88	.410	.505	.510	29.314	29.192	29.136	29.214
10	65	64	64	64⅓	78	100	89	.483	.596	.529	29.099	29.088	29.058	29 082
11	64	71	58	67⅔	89	80	88	.529	.608	.423	29.058	29.040	29.081	29.059
12	57	64	62	61	94	77	83	.436	.464	.460	29.064	29.034	28.991	29.629
13	58	55	55	56	100	100	100	.483	.433	.433	28.845	28.660	28.680	28.726
14	53	61	55	56⅓	86	71	81	.348	.383	.349	28.820	28.845	28.965	28.876
15	54	66	47	55⅔	80	63	92	.355	.407	.298	29.013	29.002	29.098	29.038
16	44	61	46	50⅓	92	66	92	.265	.354	.286	29.187	29.209	29.252	29.213
17	47	67	60	58	92	59	65	.298	.393	.338	29.313	29.273	29.240	29.275
18	57	74	63	64⅔	52	51	72	.242	.429	.416	29.183	29 114	29.164	29.154
19	59	66	47	57⅓	88	56	85	.439	.505	.273	29.139	29.139	29.243	29.174
20	41	65	55	53⅔	74	63	81	.190	.389	.349	29.261	29.198	29.173	29.212
21	50	75	65	63⅓	85	73	89	.309	.628	.549	29.144	29.089	29.101	29.111
22	63	76	68	69	83	68	79	.478	.614	.543	29.141	29.127	29.107	29.125
23	68	81	75	74⅔	79	66	73	.543	.704	.628	29.123	29.184	29.164	29.157
24	66	85	72	74⅓	89	57	76	.570	.691	.595	29.161	29.133	29.131	29.142
25	68	64	52	61⅓	85	100	86	.577	.596	.334	29.037	28.955	29.011	29.001
26	51	62	49	54	86	56	78	.321	.312	272	29.095	29.160	29.163	29.139
27	49	69	59	59	78	43	82	.272	.306	.427	29.180	29.092	29.065	29.112
28	53	71	51	58⅓	67	62	79	.269	.469	.296	29.128	29.179	29.258	29.118
29	50	63	58	57	85	55	82	.309	.442	.394	29.293	29.249	29.229	29.257
30	60	78	64	67⅓	71	43	67	.367	.409	.403	29.255	29.214	29.254	29.241
Sums														
Means				60.80	83	64	83	.390	.457	.408				29.132
Average						77			.418					

SEPTEMBER, 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	Cu. St.	00	--------	00	--------	n e	3	n w	2	..	0	69	43	--------	--------	------	------
00	--------	00	--------	00	--------	s w	2	s w	5	s w	4	77	48	--------	--------	------	------
00	--------	00	--------	50	Cir. Cu.	e	1	e	5	e	2	82	57	--------	--------	------	------
90	Cu. St.	100	Cu. St.	100	Cu. St.	s	2	s w	11	s w	3	84	53	8 a. m.	In night.	.25	------
00	Cu.	80	Cu.	00	--------	n e	3	s w	7	----	0	70	41	--------	--------	------	------
00	--------	50	Cu.	00	--------	w	3	w	5	----	0	67	49	--------	--------	------	------
100	St.	100	St.	20	Cu.		0	w	1	----	0	61	48	--------	--------	------	------
100	St.	70	Cu. St.	5	Cu.	e	1	e	2	----	0	70	51	--------	--------	------	------
100	St.	40	Cir. Cu.	60	Cir. St.	e	6	e	12	s w	2	80	59	--------	--------	------	------
100	St.	100	Cu. St.	100	Cu. St.	s e	8	s e	7	s w	3	74	60	12 m.	--------	.19	------
30	Cu.	50	Cu.	100	Cu.	s w	4	s w	2	s w	1	78	54	--------	2 p. m.	.06	------
100	Cir. St.	100	Cu. St.	20	Cir.	s w	2	w	4	----	0	67	55	--------	--------	------	------
100	St.	100	St.	100	St.	n w	1	n w	5	n w	2	57	48	In night.	--------	------	------
100	St.	100	Cu. St.	50	Cu. St.	s w	3	w	7	w	2	63	48	--------	In night.	1.02	------
90	Cu. St.	00	--------	00	--------	w	4	w	11	w	1	68	41	--------	--------	------	------
15	Cu. St.	40	Cir. Cu.	00	--------	w	1	w	5	----	0	65	30	--------	--------	------	------
00	--------	00	--------	00	--------	----	0	w	6	----	0	76	47	--------	--------	------	------
00	--------	00	--------	00	--------	w	4	w	8	w	1	76	56	--------	--------	------	------
100	Cu. St.	90	Cu.	00	--------	n e	5	n e	4	n e	2	63	40	--------	--------	------	------
00	--------	00	--------	00	--------	e	1	e	1	----	0	70	45	--------	--------	------	------
40	Cu.	100	Cu.	90	Cir. Cu.	e	1	s e	5	e	3	79	48	--------	--------	------	------
50	Cu.	50	Cu.	50	Cir. Cu.	s e	3	s e	9	e	7	81	63	--------	--------	------	------
100	Cu. St.	80	Cu. St.	100	Cu. St.	e	4	e	7	s w	5	84	64	--------	--------	------	------
20	Cu.	30	St.	00	--------	e	4	s e	8	s w	4	87	66	--------	--------	------	------
50	Cir. St.	100	Cu. St.	00	--------	s w	7	s w	5	e	1	76	45	11:30 a m	1:30 p m	.65	------
00	--------	5	Cu.	00	--------	w	6	n w	8	w	1	65	42	--------	--------	------	------
00	--------	00	--------	00	--------	w	1	s w	11	s w	4	71	50	--------	--------	------	------
00	--------	00	--------	----	--------	s w	2	s w	4	---	0	76	44	--------	--------	------	------
00	--------	00	--------	10	Cir. St.	e	1	s e	5	s	3	77	49	--------	--------	------	------
00	--------	00	--------	5	Cu.	s w	3	s w	11	s w	1	81	57	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	----	----	--------	--------	2.17	------
48	--------	46	--------	29	--------	----	----	----	----	----	----	73.23	50.20	--------	--------	------	------
			41			----	----	----	----	----	----	----	----	--------	--------	------	------

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity or per cent of saturation.			Pressure of vapor, in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	58	62	47	55⅔	81	56	77	.363	.312	.249	29.323	29.364	29.429	29.372
2	41	58	46	48⅓	91	64	78	.235	.309	.260	29.451	29.343	29.256	29.350
3	60	68	57	61⅔	76	79	75	.396	.543	.350	29.030	28.922	28.942	28.965
4	50	60	45	51⅔	78	49	61	.283	.255	.182	28.982	28.966	28.982	28.976
5	36	42	31	36⅓	80	66	89	.170	.177	.155	29.104	29.146	29.211	29.153
6	34	51	52	45⅔	71	54	66	.138	.269	.257	29.178	29.046	28.846	29.023
7	57	56	45	52⅔	75	87	84	.350	.391	.251	28.635	28.594	28.794	28.674
8	41	47	44	43	100	84	84	.257	.241	.241	28.920	29.013	29.069	29.001
9	41	56	38	45	82	69	81	.212	.308	.186	29.154	29.141	29.183	29.159
10	37	63½	46	48⅔	90	72	77	.199	.416	.238	29.066	29.091	29.053	29.070
11	49	71	46	55⅓	78	66	84	.272	.503	.262	29.112	29.103	29.209	29.073
12	46	71	46	54⅓	84	62	84	.262	.469	.262	29.280	29.292	29.365	29.312
13	45	73	46	54⅔	92	59	84	.275	.476	.262	29.411	29.343	29.329	29.361
14	49	77	64	63⅓	85	69	77	.297	.639	.464	29.281	29.206	29.153	29.213
15	59	73	62	64⅔	94	77	88	.469	.617	.491	29,073	29.017	29.065	29.051
16	58	61	46	55	88	83	92	.423	.442	.286	29.243	29.226	29.249	29.239
17	47	55	50	50⅔	78	87	93	.272	.376	.335	29.271	29.216	29.081	29.189
18	56	63	52	57	81	100	86	.363	.576	.334	28.957	28.853	29.000	28.936
19	44	58	35	45⅔	92	58	80	.265	.282	.162	29.050	29.030	29.144	29.073
20	39	58	50	49	91	64	78	.216	.309	.283	29.156	29.116	29.145	29.139
21	44	62	35	47	100	61	70	.289	.340	.142	29.203	29.190	29.183	29.192
22	32	62	48	47⅓	89	66	85	.162	.370	.285	29.164	29.071	29.054	29.096
23	38	46	35	39⅔	81	54	70	.186	.169	.142	29.219	29.198	29.262	29.226
24	29	44	40	37⅔	88	68	64	.142	.196	.160	29.269	29.267	29.255	29.264
25	35	44	38	39	90	68	91	.183	.196	.208	29.209	29.156	29.111	29.158
26	39	45	40	41⅓	91	76	73	.216	.228	.182	29.064	29.033	29.044	29.047
27	36	46	41	41	90	77	52	.191	.238	.151	29.006	28.964	28.956	28.973
28	36	54	42	44	80	67	83	.170	.282	.222	28.881	28.664	28.532	28.692
29	37	46	37	40	81	62	81	.178	.192	.178	28.844	29.053	29.180	29.026
30	31	48	36	38⅓	89	63	80	.162	.212	.170	29.211	29.201	29.224	29.212
31	40	50	45	45	82	100	100	.203	.361	.300	29.171	29.093	29.030	29.098
Sums														
Means				48.3	85	70	80	.251	.345	.247				29.096
Average						78			.281					

OCTOBER, 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Maximum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
90	Cu. St.	00	----	00	----	n e	1	e	3	n w	1	67	35	----	----	----	----
5	St.	100	Cu. St.	00	----	s w	1	s w	6	s w	6	61	35	----	----	----	----
100	Cu.	40	Cu. St.	00	----	w	7	s w	9	n w	4	74	45	----	----	----	----
00	----	90	Cu.	00	----	----	0	n w	8	----	0	60	32	----	----	----	----
00	----	00	----	00	----	n w	3	n w	5	----	0	51	29	----	----	----	----
00	----	00	----	5	Cir. Cu.	----	0	s w	0	s	10	62	34	----	----	----	----
90	Cu. St.	100	Cu. St.	90	Cu.	s w	10	w	8	w	5	64	42	----	----	----	----
100	St.	100	St.	90	Cu.	n e	5	n e	7	n w	2	45	33	----	----	----	----
00	----	50	Cu.	00	----	----	0	n w	4	w	1	61	34	----	----	----	----
00	----	00	----	10	Cu.	----	0	w	7	----	0	66	37	----	----	----	----
5	Cu.	5	Cir. Cu.	51	----	----	0	s w	5	----	0	75	41	----	----	----	----
0	----	00	----	00	----	s	1	s e	7	----	0	76	41	----	----	----	----
10	Cir.	5	Cir.	40	Cir. Cu.	----	0	s w	4	----	0	78	44	----	----	----	----
10	Cu.	50	Cu.	00	----	w	1	s w	4	s w	7	77	49	In night.	----	----	----
100	St.	50	Cu.	00	----	s w	4	s w	11	----	0	72	53	----	11 a. m.	.15	----
00	----	40	Cu.	00	----	n e	1	n e	3	e	2	66	44	----	----	----	----
100	St.	100	St.	00	----	n e	5	e	8	s e	8	56	47	----	----	----	----
90	Cir. St.	100	St.	90	Cir. St.	s e	8	s w	1	s w	1	75	41	12 m.	6 p. m.	.04	----
00	----	00	----	5	Cu.	w	1	w	10	w	2	62	36	----	----	----	----
90	Cir. Cu.	100	St.	100	St.	----	0	w	7	w	2	59	40	----	----	----	----
50	Cu.	0	----	00	----	----	0	w	9	----	0	62	36	----	----	----	----
10	Cir. Cu.	5	Cu.	00	----	----	0	w	12	w	8	65	31	----	----	----	----
0	----	80	Cu.	00	----	n w	6	n w	9	n	2	50	26	----	----	----	----
10	Cu.	100	Cu. St.	100	St.	w	1	n w	5	n	2	48	29	----	----	----	----
100	Cu. St.	100	Cu. St.	100	Cu. St.	w	3	n w	5	w	2	44	36	----	----	----	----
100	Cu. St.	80	Cu.	90	Cu.	w	4	n w	5	----	0	48	32	----	----	----	----
80	Cu.	100	Cu. St.	80	Cu.	w	1	s w	7	s w	8	46	35	----	----	----	----
15	Cu.	100	Cu. St.	00	----	s w	7	s w	12	s w	19	54	35	5 p. m.	6:30 p.m.	.15	----
50	Cu.	50	Cu.	00	----	n w	17	s w	15	s w	2	48	23½	----	----	----	----
00	----	100	Cu. St.	10	Cir.	s w	1	s w	10	s w	4	48	31	----	----	----	----
100	Cir. St.	100	St.	100	St.	s w	8	s w	5	s w	2	50	40	12 m.	In night.	.44	----
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	.78	----
42	----	56	----	29	----	----	----	----	----	----	----	60.32	36.98	----	----	----	----
42						----	----	----	----	----	----	----	----	----	----	----	----

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity or per cent of saturation.			Pressure of vapor, in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	43	45	45	44⅓	88	100	100	.248	.300	.300	29.026	29.057	28.972	29.018
2	41	44½	45	43⅓	100	88	84	.257	.258	.251	29.027	29.082	29.084	29.062
3	42	44½	41	42⅓	91	72	91	.244	.211	.235	29.078	29.027	28.940	29.015
4	42	33½	24	33	91	100	73	.244	.188	.094	28 889	28.941	29.172	29.001
5	17	35	32	28	100	70	79	.094	.142	.143	29.270	29.223	29.130	29.207
6	20	52	46	39⅓	100	53	100	.108	.208	.311	29.261	29.319	28.880	29.153
7	47½	53	33	44⅓	100	73	100	.323	.295	.188	28.760	28.689	28.891	28.780
8	27	28	28	27⅔	88	88	64	.129	.135	.099	29.154	29.291	29.414	29.286
9	25	33	31	29⅔	87	89	68	.111	.168	.118	29.486	29.414	29.211	29.370
10	27	38	31	32	88	45	68	.129	.103	.118	29.203	29.238	29.285	29.242
11	30	39	38	35⅔	78	63	81	.130	.152	.186	29.164	28.946	28.951	29.020
12	31	31	31	31	78	78	84	.136	.136	.149	29.183	29.276	29.294	29.251
13	36	53	48	45⅔	71	54	92	.149	.219	.310	29.325	29.556	29.256	29.379
14	36	38	34	36	71	72	71	.149	.165	.138	29.005	29.125	29.098	29.076
15	35	42	33	36⅔	80	82	89	.162	.222	.168	29.119	29.031	28.981	29.044
16	34	49	43	42	80	64	100	.170	.223	.278	28.923	28.908	28.542	28.791
17	46	55	54	51⅔	100	94	93	.311	.405	.390	28.435	28.435	28.335	28.402
18	34	33	33	33⅓	100	89	80	.196	.168	.150	28.437	28.540	28.676	28.551
19	31	32	33	32	89	79	70	.155	.143	.131	28.764	28.891	28.971	28.875
20	28	32	28	29⅓	88	58	88	.135	.106	.135	29.174	29.271	28.949	29.131
21	32	34	31	32⅓	79	79	68	.143	.155	.118	29.029	29.095	29.391	29.171
22	26	31	23	26⅔	75	89	50	.105	.155	.073	29.403	29.363	29.306	29.357
23	15	24	22	20⅓	82	86	73	.070	.111	.094	29.264	29.227	29.267	29.253
24	17	26	27	23⅓	83	87	88	.078	.123	.129	29.297	29.324	29.344	29.321
25	25	29	26	26⅔	87	88	87	.117	.142	.123	29.360	29.331	29.194	29.295
26	27	32	29	29⅓	88	100	88	.129	.181	.142	29.164	29.162	29.176	29.167
27	26	32	32	30	87	100	100	.123	.181	.181	29.203	29.233	29.246	29.227
28	32	35	33	33⅓	100	80	80	.181	.162	.150	29 256	29.296	29.307	29.286
29	32	37	33	34	79	71	70	.143	.157	.131	29.317	29.304	29.306	29.309
30	31	35	31	32⅓	78	79	89	.136	.155	.155	29.307	29·314	29.335	29.319
Sums														
Means				34.20	87	79	82	.159	.178	.171				29.098
Average					83			.169						

NOVEMBER, 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	St.	100	St.	100	St.	s w	4	n e	3	n e	3	47	39	9 a. m. 4 p. m.	11 a. m. In night	.08 .32	------ ------
100	St.	100	St.	100	St.	n e	2	n e	2	n e	2	44	40	--------	--------	------	------
100	St.	100	St.	100	St.	n w	2	w	3	w	6	44	37	--------	--------	------	------
100	St.	100	St.	00	--------	w	5	n w	7	n	2	45	17	11 a. m.	4 p. m.	.14	------
00	--------	100	Cu. St.	100	St.	----	0	s e	8	s w	6	53	17	--------	--------	------	------
00	--------	50	St.	100	St.	s w	5	s w	12	s w	10	55	20	8 p. m.	9:30 p m	.08	------
100	St.	20	Cu.	100	St.	s w	6	s w	16	w	18	53	26	8:30 a m	12 m.	.03	------
100	St.	100	St.	20	Cu.	w	15	w	12	w	1	28	20	--------	--------	------	------
90	Cir.St.	100	St.	100	St.	s w	6	n	6	n	6	53	26	--------	--------	------	------
90	Cu.	20	Cu.	100	St.	n e	6	n w	11	n w	7	42	25	--------	--------	------	------
50	Cir.St.	100	St.	100	St.	s w	12	s w	17	s w	5	41	29	--------	--------	------	------
100	St.	100	St.	00	--------	s e	6	s e	3	s	13	57	27	--------	--------	------	------
100	St.	90	St.	100	St.	s w	12	s	15	s w	8	58	26	In night	In night	.03	------
100	St.	100	St.	100	St.	n w	7	n w	6	w	2	28	32	--------	--------	------	------
100	St.	100	St.	00	--------	w	2	w	2	s e	4	39	30	--------	--------	------	------
00	--------	00	--------	100	St.	----	0	s w	8	s e	4	56	34	--------	8 p. m.	------	------
100	St.	100	St.	100	St.	s w	8	s w	18	s w	14	55	33	In night	In night	.95	------
100	St.	100	St.	100	St.	s w	11	s w	9	s w	9	35	30	--------	--------	------	------
100	St.	100	St.	10	Cir.	w	5	w	8	w	2	32	20	--------	--------	------	------
50	Cu. St.	100	St.	100	Cir.St.	s w	2	s w	7	s w	8	33	18	--------	--------	------	------
100	Cu.	100	St.	100	St.	w	7	n	7	----	0	36	26	--------	--------	------	------
100	Cu.	100	St.	10	Cir.	n	5	n	7	e	5	32	13	--------	--------	------	------
100	Cu. St.	100	St.	10	Cu.	n e	7	n e	7	s w	5	40	15	--------	--------	------	------
10	Cu.	100	St.	100	St.	w	6	w	7	----	9	30	17	--------	--------	------	------
100	St.	100	St.	10	Cu.	w	3	s w	2	w	9	28	25	--------	--------	------	------
100	St.	100	St.	100	St.	s w	9	s w	4	s w	2	38	15	In night	In night	.07	½
100	St.	100	St.	100	St.	e	1	n e	6	n e	3	40	25	3 p. m.	In night	.14	1½
100	St.	100	St.	100	St.	n	3	n	3	n e	1	35	31	--------	--------	------	------
100	St.	100	St.	100	Cu. St.	n e	1	e	4	----	0	37	30	--------	--------	------	------
100	St.	100	St.	100	St.	----	0	w	3	n w	1	35	30	--------	--------	------	------
----	--------	----	--------	----	--------	----	----	----	----	----	----	------	------	--------	--------	1.84	2
83	--------	89	--------	75	--------	----	----	----	----	----	----	41.97	25.77	--------	--------	------	------
82						----	----	----	----	----	----	------	------	--------	--------	------	------

METEOROLOGICAL OBSERVATIONS FOR THE MONTH OF

Day of month.	Thermometer in open air.				Relative humidity or per cent of saturation.			Pressure of vapor in inches.			Barometer reduced to freezing point.			
	7 A. M.	2 P. M.	9 P. M.	Daily Mean.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	7 A. M.	2 P. M.	9 P. M.	Mean.
1	32	35	30	32	79	80	89	.155	.178	.155	29.335	29.290	29.244	29.289
2	28	33	33	31	100	100	70	.153	.188	.188	29.146	29.019	28.951	29.038
3	36	42	34	37	80	58	70	.186	.202	.157	28.965	28.912	28.933	28.936
4	22	27	29	26	86	88	89	.106	.135	.148	29.094	29.159	29.204	29.152
5	27	31	30	29	88	89	89	.135	.162	.155	29.297	29.283	29.216	29.265
6	47	43	35	41	100	100	100	.323	.278	.204	28.919	28.911	29.005	28.945
7	34	40	38	38	100	100	100	.196	.248	.229	28.849	28.627	28.492	28.652
8	32	34	29	31	79	100	89	.155	.196	.148	28.510	28.525	28.848	28.627
9	27	32	30	27	88	89	89	.135	.168	.155	28.971	28.999	29.012	28.994
10	26	27	25	32	88	88	100	.129	.135	.135	29.056	29.111	29.203	29.123
11	25	25	20	23	100	100	85	.135	.135	.096	29.448	29.468	29.480	29.465
12	22	33	30	28	86	89	89	.106	.175	.155	29.483	29.470	29.351	29.434
13	30	35	34	33	100	100	100	.167	.204	.196	29.139	29.076	28.796	29.003
14	36	36	33	35	90	90	89	.199	.199	.175	28.993	29.064	29.131	29.062
15	27	34	33	31	88	90	90	.135	.157	.183	29.177	29.151	29 113	29.147
16	25	36	29	27	87	80	89	.123	.186	.148	29.129	29.124	29.116	29.123
17	26	30	28	24	88	89	88	.129	.155	.142	29.132	29.118	29.014	29.088
18	22	31	26	26	72	89	88	.094	.162	.129	28.952	28.855	28.839	28.882
19	29	29	10	22	100	100	79	.160	.160	.057	28.897	28.957	29.020	29.958
20	9	21	16	15	100	100	100	.065	.113	.090	29.047	29.070	29.231	29.116
21	15	21	20	18	100	86	100	.086	.101	.108	29.284	29.359	29.338	29.327
22	22	22	16	20	100	100	100	.118	.090	.108	29.317	29.399	29.308	29.341
23	15	20	15	17	100	100	100	.086	.108	.086	28.957	29.118	29.146	29.073
24	—2	17	15	11	------	67	100	.028	.071	.086	29.145	29.231	29.063	29.146
25	19	19	—2	12	85	85	100	.091	.091	.040	28.614	28.805	28.990	28.803
26	12	19	12	14	80	100	80	.063	.103	.063	28.932	29.107	29.175	29.071
27	11	21	17	16	80	86	83	.060	.101	.082	29.190	29.213	29.232	29.212
28	20	25	18	21	85	100	84	.096	.135	.087	29.264	29.268	29.281	29.271
29	16	21	8	15	83	86	78	.078	.101	.051	29.306	29.311	29.329	29.315
30	17	27	26	30	100	88	75	.094	.135	.117	29.393	29.296	29.250	29.313
31	28	32	30	30	88	79	100	.142	.155	.167	29.124	29.074	29.036	29.078
Sums	------	------	------	------	------	------	------	------	------	------	--------	--------	--------	--------
Means	------	------	------	25.59	57	90	90	.094	.148	.098	--------	--------	--------	29.092
Average	------	------	------	------	89			.113			--------	--------	--------	--------

DECEMBER, 1892, AT AGRICULTURAL COLLEGE, MICHIGAN.

Clouds.						Winds.						Registering thermometer.		Rain and snow.			
7 A. M.		2 P. M.		9 P. M.		7 A. M.		2 P. M.		9 P. M.							
Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Per cent of cloud.	Kind.	Direction.	Force.	Direction.	Force.	Direction.	Force.	Maximum.	Minimum.	Beginning, rain or snow.	Ending, rain or snow.	Inches of rain or melted snow.	Depth of snow, inches.
100	St.	100	St.	100	St.	n e	2	n e	3	n e	5	35	27	----	----	----	----
100	St.	100	St.	100	St.	s w	4	s w	3	s w	8	42	27	2 P. M.	In night	.17	----
100	Cu.	10	Cu.	10	Cu.	s w	7	w	1	w	4	45	18	----	----	----	----
100	St.	100	St.	100	Cir. St.	w	1	n	4	n w	3	28	22	----	----	----	----
100	St.	90	Cu. St.	100	St.	n w	4	s e	7	s w	9	37	25	----	----	----	----
100	St.	100	St.	100	St.	s e	6	s w	4	s w	6	43	31	----	----	----	----
100	St.	100	St.	100	St.	n w	6	s w	9	s w	6	46	31	----	12 M.	.44	----
100	St.	100	Cu. St.	100	St.	s w	5	s w	6	w	6	35	26	In	night	.29	----
100	St.	100	St.	100	St.	s w	7	s w	9	s w	6	32	18	----	----	----	----
100	St.	100	St.	100	St.	w	5	w	7	s w	1	28	20	----	----	----	----
100	St.	100	Cu.	20	Cir. Cu.	s w	1	s w	1	s w	1	29	17	----	----	----	----
100	Cu. St.	100	St.	100	St.	s w	1	n w	1	n w	1	33	22	----	----	----	----
100	St.	100	St.	100	St.	n e	1	e	7	e	7	37	28	3 P. M.	----	----	----
100	St.	100	St.	100	St.	s w	9	n	7	n e	8	36	25	In	night	.37	----
10	Cir. St.	00	----	00	----	s w	4	s w	13	n	8	36	25	----	----	----	----
10	Cu.	5	Cu.	10	Cir.	w	5	s w	6	s w	3	40	25	----	----	----	----
100	St.	100	Cu. St.	5	Cu.	n e	2	n	4	n	10	32	22	----	----	----	----
100	St.	100	St.	100	St.	s w	12	s w	6	s w	5	33	22	----	----	----	----
100	St.	100	St.	00	----	s w	3	w	7	----	0	30	3	----	----	----	----
100	Cu. St.	80	Cu. St.	90	Cu.	n w	1	n w	4	w	7	22	6	----	----	----	----
100	Cu. St.	60	Cu.	100	Cu.	w	4	n w	6	n w	5	22	11	----	----	----	----
100	Cu.	100	Cu.	100	Cu.	n w	1	n w	5	w	9	22	12	Snow	in night	.15	2
100	Cu.	85	Cu.	00	----	w	4	n w	6	----	0	22	—10	----	----	.10	----
90	St.	100	Cu.	100	Cu.	n w	1	s w	6	n w	4	22	—3	----	----	----	----
100	Cu.	100	Cu.	----	----	n w	4	n w	1	w	1	22	—2	----	----	----	----
100	Cu.	100	St.	00	----	w	1	n w	5	n w	5	20	8	----	----	----	----
100	St.	100	St.	100	St.	s w	2	n e	8	n e	3	21	11	----	----	----	----
100	St.	100	St.	100	St.	w	4	s w	9	s w	5	24	14	----	----	----	----
100	St.	00	----	00	----	s w	5	w	7	----	0	24	7	----	----	----	----
100	St.	90	Cu. St.	100	St.	w	5	s e	7	n w	3	29	16	----	----	----	----
100	St.	100	St.	90	Cu. St.	n w	3	s w	5	n w	4	35	25	----	----	----	----
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1.52	2
94	----	85	----	69	----	----	----	----	----	----	----	30.90	17.06	----	----	----	----
83						----	----	----	----	----	----	----	----	----	----	----	----

REPORT OF THE CONSULTING ZOÖLOGIST.

To the Director of the Experiment Station:

My annual report is herewith respectfully submitted.

The work of this department has been devoted quite extensively the past season to the investigation of celery insects, the result of which has already been published as a bulletin. Owing to the sudden outbreak of the little negro bug (*Corimelaena pulicaria*) in the celery fields at Tecumseh, much of my time, through the latter part of July and a part of August, was spent at that place and Kalamazoo in experimenting on this bug, and other celery pests that were abundant in the fields. It was surprising at the number of celery insects that one season's work revealed, but it only demonstrates the more conclusively the number of different insects that feed on our crops and the knowledge that we should have of each that we may deal with them to our best advantage.

Experiment work was conducted at the college to prevent the death of squash vines that annually occurs soon after the plants commence to run. The sudden death of the vines at this time is not the result of the borer as that insect is unknown in this neighborhood. The death is caused by a disease of the plant and this disease, we learn, is carried by the little striped cucumber beetle (*Diabrotica vittata*) which works on squashes and melons as well as cucumbers. If these beetles can be kept from the plants until after they begin to run, there is then little danger of the disease being carried to the plants. The substances used as preventives were air slaked lime, carbolized lime (lime slaked with carbolic acid in water at the rate of a teacupful, or a little less, to each bushel of lime), wood ashes, and wood ashes with sulphur. Three rows containing about 45 hills were taken for each substance, and the same number of untreated check rows was left between each lot. To prevent the beetles getting a start, the plants were dusted before the beetles appeared and were kept well dusted for about a month, when the plants in the vicinity began to die. The result of the experiment was that all the plants that were treated were protected in a measure. The ashes and sulphur protected the plants no better than the ashes alone, and neither of them did as well as the air slaked lime. Only three plants died in the rows dusted with carbolized lime, while, in the untreated check rows, from a fourth to a fifth of the plants were killed. The lime alone did nearly as well as the carbolized lime. The beetles, though plentiful, were not as numerous as they are some years. The mortality among the untreated plants was about the same as in previous years.

Green house insects have been woefully neglected by entomologists, and appear to be little studied or known. Suitable remedies for the tender plants are also so scarce that the florist is left largely at the mercy of patented nostrums which may or may not be what is desired. Last spring a study of these green house pests was begun, but the investigation was only well under way when World's Fair matters called me to Chicago for the next six weeks and nearly the entire research was lost. It is to be hoped that the work may continue with more favorable results the coming season.

The noticeable insect depredations of the season may be summed up in the following paragraphs:

From the many inquiries sent us from all over the State, it seems that the grain beetles and grain moth are still annoying many farmers and millers. This is no doubt due largely to the depression in the price of wheat and consequently old wheat has been summered over for better prices. In this way new wheat is often put in the same bin on the old, or close to it. The mixing of new wheat with old is a great mistake, as the bins should be thoroughly cleaned before they are ready for the new wheat. The insects breed in the bins and are not brought from the fields in new wheat as many suppose. Of course bisulphide of carbon is the remedy to kill the weevils when they are once in the grain.

Our most subtle and pernicious pests the past season, judging from the absence of live clover in the fields last fall, and the absence of seed in the heads, are the two clover insects known as the clovor root borer (*Hylastes trifolii*) and the clover seed midge (*Cecidomyia leguminicola*). For the last two or three years farmers have complained of having no clover seed in their fall crop, where they had previously had a full crop, but up to the past season the root borer has attracted little attention. At present its work is even more serious than that of the seed midge as it is becoming fully as much spread over the state, and by its work kills the plant in the second year's growth by attacking the roots. Theoretical remedies have been suggested which have never been tested by practice to my knowledge. It is to be hoped that some practical measure may be found for their control, but such a measure will probably be much more difficult than it first appears owing to our clover fields being so extensive and numerous.

From various reports and letters of inquiry the southwestern part of the state appears to have suffered considerably from an attack on grapes by the berry moth (*Eudemis botrana*). This is generally rather of a rare pest compared with the grape vine flea beetle (*Haltica chalybea*) which was also reported in several instances, but the berry moth at least attracted more attention. The grapes attacked by this caterpillar are readily recognized among the green ones by the dark color, much like a ripe grape, and on opening the grape a light colored caterpillar, nearly one-fourth of an inch long will be found. The grapes, so darkened, should be picked and destroyed, and a good precaution is to keep the vineyard free from fallen leaves and rubbish during winter.

Another grape vine insect not usually known, was found at Tecumseh sucking the sap from the leaves in such great numbers that the leaves and entire plant were suffering from the attack. These little leaf hoppers are quite small, little more than an eighth of an inch long, and are a yellowish white with three black cross bands. This gives them the name, three lined leaf hopper, or *Typhlocyba tricincta*. A spray of kerosene emulsion readily subdued them.

A five acre field of raspberries at Clio was reported as suffering from an attack of the raspberry saw fly (*Monophadnus rubri*). Spraying with arsenites was recommended.

The little peach bark beetle (*Phlœotribus liminaris*) has again made its appearance in the vicinity of South Haven. It works in the trunk and limbs of live trees, and the little holes made through the bark by it. resemble the perforations made by fine shot fired into the tree from a gun. Whole orchards have been killed by its work. We hope it will not become extensive.

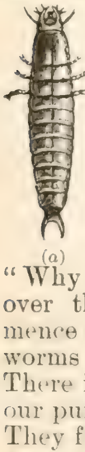
Many other more common pests such as the canker worms, white marked tussock moth, plant lice, carpet beetles, etc., were also reported in their season as doing damage, but these are so common and often spoken of that it is hardly necessary to mention them farther.

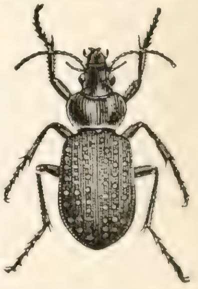
It is very encouraging to note the increasing interest taken by farmers and fruit growers in learning all they can regarding these profit reducers that they may be the better prepared to successfully cope with them. The department is ever ready to assist what it can in increasing and perfecting this knowledge.

Before concluding this report, I should like to add a letter received from the northern peninsula regarding one of our beneficial insects. The letter is as follows:

> "Gentlemen—I send you herewith a larva that I captured yesterday morning which is a regular terror to destroy cut worms. It also eats grasshoppers and does it in a wolfish way. When it once takes hold of a cut worm it never lets go until it has eaten the whole inside out. Last year about this time, I caught one of these larvæ while picking cut worms and I supposed at the time that it was a plant destroyer, but I had hardly dropped it in with the cut worms (had them in a bottle where I could see its actions plainly) when it went to work and nabbed one of the worms, and in less than two minutes it had sucked the entire inside out. Then another was taken. It was then noon and I went home for dinner, but first took out all the cut worms except twelve large ones. I supposed this would be enough for the day, but no. By the time I had eaten my dinner, which took about half an hour, the larva had eaten every one of the cut worms, so I took it back to the field and left it to hunt its own grub which it had no trouble in finding here last year."
>
> "This year the cut worms are very scarce here, but there are some. This larva which I send you, I caught in the city. I was talking with a lady when I saw it running on top of the ground and then run under a sod, among some potatoes to hide. I recognized it and at once captured it. Then I told the lady what it was capable of doing, and we went back to the garden where she thought she could find some cut worms. We found none, so the lady put a grasshopper in the box with it and it nabbed the hopper at once. Twenty minutes later when I wanted to show it to a party, I found the half-grown hopper all eaten except one leg. Last night I found three cut worms and put them in with it, but all was dark then. Had it under lamp light and it would not touch them, but this morning, when I opened the box, I found there was nothing left but itself and a lot of dirt. I believe it does not eat at night. Perhaps this is the reason it has such a terrible appetite during the day."
>
> "I wish you would write me the name of this larva and tell me where its home is as I think it is a stranger here. Also let me know if it destroys plants. I wish you would experiment with it and write results."
>
> R——. B——.

The larva which he sent is shown at *a* in the cut. It is the young or larval stage of the imago or mature beetle which is shown at *b*. The name by which it is known is the cut worm lion or scientifically as *Calosoma calidum*. It is a native of Michigan and probably all of North-eastern U. S. In all stages they live concealed from view as much as possible by living under sods, boards or rubbish and so are not often seen. The larva attracted considerable interest here at the college as we had just passed through a troublesome cut worm attack ourselves. Several times I was accosted with the question "Why can't they be reared in quantities and distributed over the cornfields at the time the cut worms commence work?" No doubt this would be a great help in keeping the cut worms subdued if we could turn enough of these hunters loose in the field. There is at least one hindrance that would preclude us from accomplishing our purpose in the breeding of the larvæ, and that is, they are cannibals. They feed as readily upon each other when an ample supply of food is not furnished them as they do upon the cut worms naturally. As it is, they


(a)


(b)

are often found around the young corn in searching for cut worms and can be readily told by being a sooty black and in having the small appendages at the tip of the abdomen. Quite often I have found one in a hill of corn in the place of a cut worm it had just eaten, but not in time to save a stalk of young corn which was already wilting from the work of the cut worm. One of these larvæ will eat several fat cut worms, each one larger than itself, until its sides are distended ready to burst, and then it will be dormant for some time digesting its hearty meal. The larvæ are undoubtedly a help in reducing the number of cut worms, and they should be known, and considered our friends. A little later in the season when these larvæ have become imagos, or beetles, they still feed on cut worms and other caterpillars, but are not as often seen as they are more shy and retiring.

Respectfully submitted.

G. C. DAVIS.

AGRICULTURAL COLLEGE,
December 30, 1893.

REPORT OF CONSULTING BOTANIST.

To the Director of the Experiment Station:

DEAR SIR—The following report of the consulting botanist of the experiment station for 1893 is respectfully submitted.

EXAMINATION OF SEEDS.

During the past year an increasing number of samples of seeds of grasses, clovers and other forage plants have been received and examined for impurities and adulterations.

The number of weed seeds found in many samples of commercial seeds shows the urgent necessity of a careful examination in order to prevent the wholesale spread of weed pests throughout the state.

PLANTS TO BE NAMED.

Several hundred plants have been received for names during the year, many of which are weeds sent by farmers and gardeners.

FUNGUS DISEASES OF PLANTS.

Collection of paraisitic fungi which attack our cultivated and wild plants, including smuts, rusts, mildews, etc., were made both on the college grounds and in the immediate vicinity.

Numerous questions relating to plants and plant diseases have been answered involving a considerable outlay of time and research.

GERMINATION TESTS.

Forty samples of the flat pea, *Lathynes Silvestris*, were placed in a Genera seed-tester, after being subjected to treatment in hot water at temperatures ranging from 140° to 212 Fahr. The different samples remained in water from five minutes to forty-eight hours. Results were reported to the director of the station.

SMUT EXPERIMENTS.

Some time during the month of June was spent looking after the various smut experiments undertaken for the prevention and cure of smut in corn, wheat, oats and barley. These experiments were begun by Prof. P. G. Holden before his resignation.

WHAT KILLED THE SHEEP?

Early in June Messrs. P. Farrand & Sons, extensive farmers of Colon, Branch county, wrote to the president of the college asking to have some person sent to examine into the cause of the sudden death of a number of their sheep. June eighth the consulting botanist visited Colon, and learned the following facts:

At noon June 2, 1893, one hundred and sixty sheep were turned into a field of seventeen acres in which corn had been grown the year before. The next morning some of the sheep were found to be sick. At noon two had died and the remainder of the flock were then put into another field.

During Saturday and Sunday six more sheep died. No more sheep were taken sick after the removal from the corn stubble.

This field had not been cultivated during the present season, before the sheep were turned into it, and had become thickly covered with a luxuriant growth of shepherd's-purse, *Capsella bernsa-pastoris*, and sleppy catchfly, *Silene antinhina*. The fungous disease known as white rust, *Cystopus candidus*, was abundant on the shepherd's-purse distorting the plants very much. From all the information gained, it seems that the death of the sheep followed eating the diseased shepherd's-purse. J. H. Steele in diseases of the sheep p. 337, states that "sheep have been known to succumb to a charbon-like affection when they have eaten the ordinary shepherd' spurse on which grew *uredo condida*" or the white rust.

Respectfully submitted,

C. F. WHEELER,

Consulting Botanist Experiment Station.

AGRICULTURAL COLLEGE,
June 30, 1893.

EXPERIMENT STATION BULLETINS.

VEGETABLE TESTS.

No. 90.—Horticultural Department.

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During the past season we have grown many of the novelties offered by the seedsmen in their catalogues of 1892. Many of the high priced "novelties" are inferior to the older and well-known sorts, although some are of real merit. In this bulletin we have endeavored to give the results gained from the experience of one season. Perhaps another year's trial might change our opinion in some instances. Some of the best of the older kinds have been grown with the new, for comparison. The summary at the end of each class may aid the grower in selecting varieties for planting.

BUSH BEANS.

The beans were planted in drills two and one half feet apart, June 10 and 11. Ten feet of drill were given to each variety. In this space one hundred beans were planted; from the number coming up the per cent. of germination was computed. After all the beans had germinated that would do so, each section was thinned to thirty plants; these thirty plants were divided in two parts of fifteen each; with one section the pods were picked and weighed when in edible condition. In this way the comparative productiveness of the several varieties was determined. The other lot of fifteen plants was allowed to ripen the pods, and the beans were shelled and kept for seed. Owing to the continued rains in the spring, the beans were not planted until late in the season; the differences in time of edible maturity of the varieties are therefore slight.

The following table shows the results obtained with the bush varieties:

TABLE No. 1.

Number.	Variety.	Seedsman.	Days to vegetation.	Per cent of vegetation.	Days to bloom.	Days to edible maturity.	Weight of green pods.—Ounces.	Days to ripening.
1	Aroostook	Jerrard	5	80	35	51	30	110
2	Best Dwarf	Burpee	5	78	38	50	70½	113
3	Bismarck	Landreth	6	52	38	51	28½	94
4	Blue Podded Butter	Burpee	5	89	37	50	28	94
5	Boston Market	Salzer	5	93	34	50	26½	116
6	Burlingame	Maule	5	86	40	51	64	......
7	Butter Wax	Maule	10	8	38	50	72½	116
8	Challenge	Ferry	5	80	33	49	15	92
9	Champion	Ely	7	98	40	52	34½	94
10	Cylinder Black Wax	Henderson	5	88	38	52	65	109
11	Dakota Soup	Maule	5	95	37	50	35	93
12	Date Wax	Dreer	10	75	38	52	49½	110
13	Detroit Wax	Ferry	11	65	38	52	24½	94
15	Earliest	Maule	5	88	34	51	40	104
16	First Market	Landreth	7	77	35	52	39	100
17	Flageolet Wax	Henderson	6	90	37	49	9½	93
18	Gold Dot	Hicks	5	90	38	52	40	94
21	Gold-eye Wax	Salzer	10	5	35	51	49½	94
23	Mammoth Wax	Henderson	7	66	38	52	54	98
24	Mont d' Or	Ely	5	87	34	52	57	98
25	Ne Plus Ultra	Ely	4	96	34	57	29	98
26	Newtown	Thorburn	7	90	37	51	55	98
27	No. 1½	Hatt	4	94	42	50	27	118
28	No. 2	Hatt	4	96	39	50	83	110
29	No. 2½	Hatt	5	84	40	51	70½	118
30	No. 3	Hatt	6	81	41	52	32	110
31	Osborn Forcing	Henderson	5	96	38	51	33½	84
32	Perfection Wax	Dreer	6	96	38	52	37½	90
33	Pink-eye	Landreth	7	22	35	51	31½	90
34	Plymouth Rock	Gregory	6	86	34	52	22½	90
35	Red Valentine	Henderson	6	74	38	52	35	84
36	Refugee	Henderson	5	50	38	51	67½	84
37	Ruby Dwarf Horticultural	Rawson	8	93	42	52	28	84
38	Rust-proof	Vaughan	5	92	35	51	27½	84
39	Saddle-back	Landreth	5	59	35	52	36	100
40	Shah	Thorburn	5	91	40	53	22½	88
41	Snowflake	Gregory	4	92	40	52	80	100
42	Speckled Wax	Ferry	7	85	38	51	30	88
43	Violet Flageolet	Ferry	6	94	38	52	47½	84
44	Wardwell	Salzer	5	94	38	51	41	100
45	Warwick	Henderson	5	99	38	51	48½	84
47	White Valentine	Henderson	5	81	37	52	63½	90
48	William	Vaughan	5	99	34	49	46	90
49	Yellow-eye Wax	Leonard	10	11	39	51	10	116
50	Yosemite	Gregory	7	78	38	52	57½	......
51	Queen Wax	Hicks	5	88	38	51	51	90
55	Shipper's Favorite	Buist	6	99	39	53	52	116
57	Horticultural (strain No. 14)	Hicks	9	100	32	66	29	100
58	New Field Bean No. 6	Hicks	9	100	33	50	51	100
59	Early Dwarf Bush No. 3	Hicks	9	99	32	48	31	90

DESCRIPTION OF VARIETIES.

The following notes apply to the new varieties grown in 1892. Notes on the other varieties will be found in Bulletins 70 and 79.

Boston Market—Salzer. Plants 9 to 12 inches high, spread 8 to 12 inches; leaflets small to medium in size; pods round, green, 2½ to 3½ inches long, curved, apex long; flesh solid, tender. Bean small in diameter, long, purplish red in color with lighter dots. The plant does not grow large enough to be very productive.

Butter Wax—Maule. Plants of medium growth; foliage medium in size, dark green color; pods 4 to 5½ inches long, round, rich golden yellow color and of excellent quality. Pods remain some time in edible condition. Bean large, white with a brownish-red eye. Very productive. A good variety.

Plymouth Rock—Gregory. Plants strong and vigorous, 10 to 12 inches high; spread 12 to 15 inches; leaflets medium to large, dark green; pods green, straight, flattened, 5 to 6 inches long; flesh tender and of best quality. Bean small in diameter, long, round, kidney-shape; color white with reddish-brown dots around eye. An excellent variety, but not remarkably early this year.

Shipper's Favorite—Buist. Plants strong and vigorous, closely resemble Plymouth Rock in plant and pod, though the pods are longer and not so wide. Bean small in diameter, long, purplish-red in color with lighter dots. A good variety and productive.

Horticultural (*Strain No. 14*)—Hicks. Plants of moderate growth; foliage medium in size, dark green in color; pods 4 to 5 inches long, light yellow with dark purple patches; quality good. Moderately productive. Bean thick, nearly round, creamy yellow in color with reddish patches.

New Field Bean, No. 6—Hicks. Plants strong and vigorous; foliage large, light green in color; pods 5 to 6 inches long, yellowish-green. Bean large, white, round. Productive. Promises to be an excellent field bean.

Early Dwarf Bush, No. 3—Hicks. Plants of small growth; foliage small, dark green color; pods dark green, more or less covered with purplish-black spots; quality good. Bean small to medium in size, creamy-yellow, dotted with blue-black spots. Moderately productive.

Though the recent introductions have many points of excellence, not one is so superior to the older sorts as to supersede them for field or garden use. Our list of varieties for planting would be little changed from those recommended last year.

Wax beans—Cylinder Black Wax, Saddleback, Mammoth Wax, and Butter Wax.

Green podded varieties—Osborn Forcing, Shipper's Favorite, Dakota Soup, and Shah.

For field culture—Burlingame, Snowflake, Hatt No. 2½ and No. 6 Hicks.

POLE BEANS.

The pole beans were planted June 14 in rows 6 feet apart, with 4 feet space between the hills. The poles were placed in position at the time of planting the beans.

The following table shows the comparative data obtained:

TABLE NO. 2.

No.	Variety.	Seedsman.	Days to vegetation.	Per cent of vegetation.	Days to bloom.	Days to edible maturity.
1	Black Lima	Burpee	13	86	53	------
2	Challenger	Thorburn	13	12	55	------
3	Golden Champion	Hend.	13	70	53	102
4	" Cluster	"	13	61	65	119
5	Hort. Lima	Childs	13	90	35	93
6	" "	Hicks	13	98	38	93
7	Jersey	Hend.	13	24	47	------
8	Old Homestead	"	13	80	42	97
9	Scarlet Runner	Dreer	13	84	35	------
10	Seek-no-further	Land.	13	76	47	97
11	Sunshine Wax	Burpee	13	64	62	121
12	White Zulu	Burpee	13	98	38	100
13	Willow-leaf	Burpee	13	60	56	------
14	Giant Horticultural	H. N. Smith	13	60	63	139
15	Washington Market	Leonard	13	30	47	------
16	Ford's Mammoth	Hend.	13	52	47	------

DESCRIPTION OF VARIETIES.

Golden Champion—Hend. This variety, as last year, was the earliest of the wax pole-beans to form edible pods. The pods are nearly white, 4 to 5 inches long and of good quality. A valuable variety.

Golden Cluster—Hend. None of the newer sorts equal this variety as a wax-podded pole bean for general garden culture. The plants are of strong and vigorous growth and very productive. The pods are 6 to 8 inches long; flesh thick, solid, and of best quality. It is not so early as Golden Champion, but on the whole was the best bean of its class grown.

Horticultural Lima—Childs. Plant vigorous; foliage dark green; pods 5 to 6 inches long, and 1 inch broad, they contain 4 to 6 beans of large size. This is a Lima, and the beans are edible long before the broad-podded Limas or the bush varieties. It is productive and a valuable acquisition.

Horticultural Lima—Hicks. This variety is identical with the above. We think that Childs was the original introducer.

Old Homestead—Hend. Plants are strong and moderately productive. Pods long, curved and twisted, green, tender and of best quality. A good green-podded variety.

Seek-no-further—Landreth. Identical with Old Homestead.

Sunshine Wax—Burpee. Identical with Golden Cluster.

White Zulu—Burpee. An introduction of 1891. As grown last year the type was not well fixed. Plants vigorous, pods 6 to 10 inches long, usually twisted sidewise, light green in color, and of best quality. Productive. A good variety,

Willow Leaf—Burpee. Interesting as a novelty. Does not mature beans here.

Giant Horticultural—Smith. Plants are moderately vigorous. The pods are borne near the ground, and are five to six inches long, one inch broad, light yellowish-green in color, more or less streaked with purple. Bean large, thick, medium in shape between a kidney bean and a Lima; excellent in quality. Rather late in maturing and moderately productive.

Evidently a cross between the Dwarf Horticultural and a pole Lima. A valuable addition to the list of varieties.

Golden Champion is valuable for its comparative earliness. As a snap bean of the best quality, and wonderfully productive, the Golden Cluster can not be too strongly recommended. As a Lima bean the Horticultural Lima has no superior for this section.

BUSH LIMAS.

Of late, the bush Limas have attracted considerable attention. Their season of maturity is usually too late to make their culture successful in this latitude.

TABLE NO. 3.

No.	Variety.	Seedsman.	Days to vegetation.	Per cent of vegetation.	Days to bloom.	Days to edible maturity.
1	Burpee's Bush Lima	Burpee	12	66	42	102
2	Dreer's Bush Lima	Dreer	11	36	52	102
3	Hend. Bush Lima	Hend.	12	30	42	88
4	Bush Lima	Barteldes	11	80	39	106?

DESCRIPTION OF VARIETIES.

Burpee's Bush Lima—Burpee. Plants are strong and vigorous. Pods 4½ to 5 inches long, 1½ inches broad, and curved, usually contain 3 to 4 beans, which are 1 inch long and 1 inch broad, kidney-shape. The plants are moderately productive.

Dreer's Bush Lima—Dreer. Plants are of smaller and more spreading growth than the preceding. Pods are borne in clusters near the ground; 2½ to 3½ inches long, 1½ inches broad, straight. The beans are smaller than Burpee's Bush Lima andthe plants are more productive.

Henderson's Bush Lima—Hend. Plants are strong and of vigorous growth; pods 3 to 4 inches long, straight, borne on all parts of the plant, beans medium in size, and of best quality. The earliest of the bush Limas and perhaps the best.

Barteldes' Bush Lima—Barteldes. Plants very strong-growing, inclined to climb, pods 4 to 6 inches long, somewhat flattened, outer surface rough, borne in clusters on a long stem. The plant is very productive, but matures beans too late for this section.

CABBAGES.

Thirty varieties were tested this year. The seed was sown on March 10 and the plants were pricked out in flats about the 1st of April. On May 8 twenty-five plants of each variety were transplanted in the field. They were badly affected by the maggot (*Anthomyia brassica*), which resulted in much irregularity in heading. The very wet weather, during June, was largely instrumental in preventing a failure of the crop from the ravages of the maggot. The following table gives the results of the test.

TABLE NO. 4.

No.	Variety.	Seedsman.	Per cent germinated. Tester.	Per cent germinated. Soil.	Per cent of planted that headed.	Average size of head in inches.	Condition of head.	Days to market maturity from planting.
1	Acme	Burpee	99	89	92	8x10	Solid.	90
2	All Head	Burpee	96	86	64	6x4	Fair	84
3	All Seasons	Ferry	85	89	84	8x5	Solid.	90
4	American Savoy	Ferry	100	90	80	6x4	Loose	95
5	Autumn King	Henderson	98	35	100	6x10	Solid.	100
6	Bridgeport	Vaughan	97	85	84	12x8	Solid.	105
7	Burpee's World Beater	Burpee	98	87	96	8x5	Solid.	100
8	Dwarf Flat Dutch	Ferry	100	74	100	6x6	Solid.	65
9	Earliest of All	Faust	96	93	64	4x7	Solid.	50
10	Etampes	Faust	93	73	84	4x8	Solid.	60
11	Express	Ferry	99	93	68	4x7	Solid.	70
12	Fottler's Drumhead	Ferry	100	95	80	8x5	Solid.	85
13	Giant Red Erfurt	Vaughan	91	81	84	5x5	Solid.	90
14	Late Flat Dutch	Ferry	96	91	96	9x7	Solid.	82
15	Lightning	Salzer	99	62	96	4x8	Solid.	62
16	Luxemburg	Ferry	90	91	84	8x5	Solid.	95
17	Main Crop	Burpee	100	91	44	8x5	Soft	95
18	Mammoth Rock Red	Ferry	98	97	76	5x5	Solid.	95
19	Marblehead	Ferry	98	94	96	10x6	Fair	110
20	Marvin's Savoy	Vaughan	84	58	52	6x4	Soft	85
21	Reynold's	Gregory	83	60	88	8x5	Solid.	85
22	Rothselburg	Gregory	89	68	56	8x5	Fair	85
23	Stone Mason	Ferry	99	100	32	7x4	Fair	90
24	Succession	Ferry	100	90	88	11x7	Solid.	100
25	Vandergaw	Vaughan	99	100	80	5x8	Solid.	90
26	Winnigstadt	Vaughan	97	78	88	5x8	Solid.	70
27	Prize Head Flat Dutch	Faust	94	88	92	9x7	Solid.	90
28	Late Drumhead	Buist	93	92	64	8x4	Fair	100

EARLY VARIETIES.

Earliest of All was the first to head. It had a tendency to form several heads, which is an unusual occurrence.

Lightning is a good strain of the Early Wakefield type, and is a very uniform header. Not as early as was advertised.

Etampes is known as a reliable early variety, but it headed somewhat unevenly this season. Quite desirable.

SECOND-EARLY VARIETIES.

Dwarf Flat Dutch follows very closely the early varieties. It is a sure header and a compact grower. Its increased size and solid heads cause it to supersede the earlier varieties as soon as it appears in the market.

Winnigstadt is an old favorite, and is a very reliable header. A valuable variety where a conical head is desired, on account of its sureness of heading.

Fottler's Drumhead was somewhat uneven this season. It is a desirable cabbage for general purpose. Planted late it makes a good winter variety, although early planting brings its season in August.

MEDIUM SEASON.

There seems to be but little choice between the *Acme*, *Vandergaw* and *Prize Head Flat Dutch*, which are the three best of the varieties maturing in three months after transplanting.

LATE VARIETIES.

Bridgeport forms very large heads, and most of them are quite solid. One of the best.

Succession is very much like the preceding variety.

Burpee's World Beater, is the best of the acquisitions of this season. Its uniform and solid heads make it desirable, and judging from its appearance in the field, it ranks high.

Autumn King formed uniformly large, solid heads. The type is not fixed. Some of the heads were flat, others oval.

Giant Red Erfurt and *Mammoth Rock Red* are very similar in size. Both form round, solid heads. They are distinguished by a slight difference in the color of the leaves, those of the latter having more of a purple tinge. They are valuable because of their keeping qualities.

SWEET CORN.

Twenty-eight varieties were used in the test. The hills were four feet apart each way. Five kernels were planted in each hill, and twenty hills of each variety were used in the test.

The planting was done on May 20.

The dry hot weather, during the latter half of August, hastened the date of maturity of all except the early varieties.

The following table gives the principle data of the test. The last column shows the comparative productiveness of the varieties.

TABLE No. 5.

Number.	Variety.	Seedsman.	Days to edible maturity.	Days to market maturity.	Length of stalk in feet.	No. of stalks bearing ears.	Number ears.	Av. No. ears per stalk.
1	Bonanza	Vaughan	79	88	5¾	68	97	1.42
2	Burlington Hybrid	Faust	75	79	5	79	89	1.13
3	Concord	Ferry	81	87	4½	68	78	1.15
4	Cory	Ferry	75	78	3¼	43	48	1.12
5	Country Gentleman	Henderson	96	99	5¾	63	111	1.76
6	Crosby	Ferry	74	77	3	49	50	1.02
7	Egyptian	Ferry	91	93	6¾	77	101	1.30
8	Excelsior	Landreth	92	96	4¾	66	106	1.41
9	First of All	Burpee	67	70	3¾	35	42	1.20
10	Ford's Early	Vaughan	77	80	3¾	42	50	1.19
11	Gold Coin	Vaughan	96	99	7	60	90	1.50
12	Golden Nugget	Vick	77	81	4¾	38	52	1.36
13	Henderson	Henderson	89	53	7	76	101	1.41
14	Leet's Early	Ferry	74	77	4½	61	65	1.06
15	Mexican	Ferry	78	82	5½	68	98	1.44
16	Minnesota	Ferry	82	93	4½	58	79	1.36
17	None-such	Maule	81	88	6¼	82	122	1.49
18	Northern Pedigree	Ferry	75	78	3¼	50	55	1.10
19	Old Colony	Ferry	82	93	6	43	72	1.67
20	Pee & Kay	Ferry	77	81	4¼	48	54	1.12
21	Perry's Hybrid	Ferry	77	80	4¾	65	71	1.09
22	Red Cob	Henderson	87	91	6	63	80	1.26
23	Red Evergreen	Childs	90	93	7	38	44	1.15
24	Stowell's Evergreen	Ferry	90	93	6½	66	80	1.21
25	White Cob Cory	Ferry	72	77	2½	55	58	1.05
29	Ne Plus Ultra	Henderson	92	96	5¼	38	71	1.86
30	Early Marblehead	Henderson	77	81	2¾	40	51	1.27
31	Shaker's Early	Henderson	81	88	5	61	79	1.30

The following are new varieties:

First of All—Burpee. This was the first variety to reach edible maturity. It also proved to be the most productive of the early sorts.

Burlington Hybrid—Faust. This is a cross between Adams' Extra Early and Early Mammoth, and is a flint corn. It has a very small amount of leaves, and stands drought. It can be planted close. Season the same as the Cory. It is desirable as it is a sure cropper. Quality fair.

Country Gentleman—Henderson. This was the latest variety to mature, and was this year one of the most productive. It originated by selection from the Ne Plus Ultra which it resembles, although the ears are larger.

Golden Nugget—Vick. A variety of medium season, and is of fair productiveness. Ears are of good length. Color orange.

VARIETIES TO PLANT.

For succession First of All for early; Golden Nugget or (Black) Mexican for medium season, and for late season Ne Plus Ultra or Country Gentleman where numerous but medium-size ears are desired. For varieties with larger ears Stowell's Evergreen, Old Colony, or Henderson are the most prominent, particularly for market.

CUCUMBERS.

The cucumbers were planted in rows 6 ft. apart, the hills 4 ft. apart in the rows. Various remedies were tried for the cucumber beetle. None proved entirely effectual, though a teaspoonful of turpentine thoroughly mixed with a pailful of ashes prevented their ravages until the plants were strong enough to resist attack.

The varieties grown for pickles were planted near each other, and as soon as the fruits were of suitable size, those from each sort were counted and weighed. It was found that the plants would produce a much larger yield during the season, if the fruits were closely picked and not allowed to grow beyond pickling size. The same method of picking and weighing the cucumbers was pursued with the table varieties.

In this way material was obtained for a comparative test of varieties.

PICKLING VARIETIES.

Chicago. Plants vigorous and productive; fruit small; spines large, black. Early. Excellent for pickling.

Chinese. Plants fairly vigorous, not so productive as Chicago; fruit small, slender; spines white, large.

Choice. Plants of moderate growth, producing a large number of small fruits. A good variety for small pickles.

Cluster. Plants healthy, strong-growing and very productive; fruit small to medium; spines large, numerous. Early. One of the best for pickling.

Jersey Pickle. New. Plants moderately healthy and fairly productive; fruit small; spines not numerous, black. Medium early.

Maule's Early. Plants vigorous and healthy; fruit small, triangular. Productive. Early. Excellent for pickles.

Parisian. This variety produces long, slender fruits. This season the plants lacked vigor and productiveness.

The following varieties may be grown both for table use and for pickles:

Bismarck. Plants are vigorous-growing and healthy; fruit 10 to 12 inches long and 2 to 2½ in diameter, tapering toward ends. Moderately productive.

Everbearing. Plants vigorous and very healthy; fruit 10 to 12 inches long, round: obtuse ends. Productive, bearing well to close of season.

Evergreen. Plants fairly vigorous and healthy; fruit shorter and larger in diameter than Everbearing. Excellent for pickling and for slicing. Moderately productive.

Short Green. Plants vigorous and healthy; fruit 4 to 5 inches long, 2 to 2½ inches in diameter. Fairly productive. Not so good for table use as some others.

TABLE VARIETIES.

Goliath. New. Plants of strong and healthy growth; fruit long, slender, crooked, and irregular; spines black, prominent. Productive.

Peerless. Plants strong, healthy, and productive; fruit large, covered with prominent white spines. One of the best for table use.

Perfection. An excellent variety for pickles when young. Form regular. Quality best. Productive.

Ivory Monarch. New. Plant a vigorous grower; fruit long, slender, white; core very small; quality good. Not very productive.

White Pearl. Plant a strong grower, but not healthy; fruit medium in size, smooth; quality good. Fairly productive.

The preceding notes are from observations of the past season's growth only, and are not to be taken as a decisive test of the several varieties.

LETTUCE.

About forty varieties have been grown during the year. For forcing purposes no variety has been found superior to Grand Rapids. Chicago, White Tennisball and Golden Queen are also good forcing varieties.

For hot-bed growing, Chicago, Hanson, Simpson, Golden Queen, Big Boston, and New York are good varieties.

As varieties for general garden culture, Hanson, Simpson, New York, Grand Rapids, Denver Market, White Star, and Chicago are all good.

The following table shows the comparison of the varieties grown out of doors. The plants were grown in the forcing-house and transplanted in the garden May 3.

TABLE No. 6.

Number.	Variety.	Seedsman.	Days to vegetation.	Per cent of vegetation.	Days to edible maturity.	Days to starting of seed-stalk.
1	All Cream	Salzer	7	66	53	60
2	Bath Cos.	Rawson	5	55	54	61
3	Big Boston	Henderson	5	72	52	54
4	Blonde Beauty	Vaughan	5	63	56	61
5	Black Seeded Simpson	Vaughan	6	34	53	59
6	Black Seeded Tennisball	Rawson	5	76	45	54
7	Boston Curled	Rawson	6	65	49	57
8	Boston Market	Rawson	5	57	45	49
9	Chicago	Vaughan	5	81	50	57
10	Colossal	Salzer	7	57	53	57
11	Curled India	Landreth	6	36	59	63
12	Curled Simpson	Vaughan	5	79	53	59
13	Deacon	Rawson	5	81	49	59
14	Denver Market	Vaughan	5	78	59	63
15	Forcing	Landreth	4	84	53	58
16	French Blockhead	Thorburn	7	80	51	59
17	Golden Curled	Landreth	6	59	53	56
18	Golden Stonehead	Vaughan	5	71	51	57
19	Grand Rapids	Ferry	5	6	53	59
20	Green Fringed	Rawson	7	6	53	57
21	Hanson	Rawson	5	71	58	63
22	Hittinger's Belmont	Burpee	5	81	45	48
23	New York	Henderson	4	74	59	63
24	Prize Head	Ferry	5	70	53	59
26	Rudolph's Favorite	Vaughan	7	67	49	57
27	Self-folding Cos.	Ferry	5	41	51	55
28	Sunlight	Salzer	6	55	48	58
29	Stubborn Head	Vaughan	7	23	50	58
30	Thick-head Yellow	Burpee	4	69	51	57
31	Tilton's White Star	Ferry	6	77	53	59
32	Trianon	Dreer	5	57	56	60
33	Year Round	Rawson	4	39	52	57
35	Golden Queen	Henderson	6	51	46	50
40	Perfection	Buist	3	68	46	49
41	Yellow Market	Buist	4	56	51	58

The following varieties were grown here for the first time this season:

All Cream—Salzer. This variety is identical with the old Prize Head, an excellent garden sort.

Blonde Beauty—Vaughan. Heads large, loose, golden yellow in color, crisp and of best quality. An excellent summer sort. This variety appears identical with French Blockhead grown last year. *Sunset* —Hend, also is identical with above.

Colossal—Salzer. New. Heads large, loose, light green in color. Matures early and is of best quality.

Hittinger's Belmont—Burpee. Same as Big Boston.

Self-folding Cos—Ferry. New. Forms large head, nearly self-blanching. Leaves tender and of best quality. The best cos variety tested.

Sunlight—Salzer. Heads medium size, golden-yellow color; leaves wrinkled, curled. A good variety if better selected.

Stubborn Head—Vaughan. New. Forms a large, loose head, light golden-yellow color. A good grower; resists heat well and remains a long time in marketable condition. One of the best varieties grown.

Thick-head Yellow—Burpee. Heads large, solid, light greenish-yellow color; leaves waved. A good summer variety.

Perfection—Buist. Heads small. Soon runs to seed.

Yellow Market—Buist. New. Heads are small, solid, golden-yellow color, tender and of good quality. Lacks in size of head and soon runs to seed.

PEAS.

A comparative test of fifty-five varieties of pea was made, using two hundred seeds of each kind. The vines were supported by a woven wire trellis. The date of sowing was May 9. Cold, wet weather injured the germination somewhat, and the dry, hot winds of the latter half of July hastened the date of maturity of the mid-season and late sorts, and prevented the proper filling of the pods in many varieties; but at the same time, it showed more clearly the ability of certain varieties to withstand adverse conditions.

Below are the tabulated data of the varieties. The dates to maturity show that the early varieties required a few more days to reach maturity than they did during the previous year, and the later varieties a few days less.

The columns showing the average number of pods per vine, and the average number of peas per pod, illustrate the prolificness of the varieties. The columns giving the weights of fifty pods and the shelled peas will give an idea of the size of the pods and the proportion of shelled peas to the pods. The last column gives the weight of the pods of an average vine. It is obtained from the data in the second and fifth column and is a measure of the productiveness of the variety.

TABLE NO. 7.

Number.	Variety.	Seedsman.	No. days to edible maturity.	Av. No. pods vine.	Av. No. peas per pod.	Av. No. peas per vine.	Wt. of 50 pods in ounces.	Wt. of shelled peas from 50 pods in ozs.	Av. yield per vine in ounces.
1	Abundance	* Ferry	69	10.00	4.44	44	8.12	48.7	1.62
2	Admiral	* Henderson	66	7.87	5.94	45	6.12	4.5	.97
3	Advancer	* Ferry	63	9.83	5.60	55	8.12	5.4	1.6
4	Alpha	* Ferry	58	8.53	6.04	51	9.0	3.5	1.5
6	American Wonder	* Ferry	54	8.83	6.26	44	6.4	3.8	1.1
7	Bergen	* Burpee	50	5.72	4.88	28	9.0	3.5	1.0
8	Bergen+American Wonder	College	52	8.01	4.00	32	8.5	3.5	1.4
9	Bergen Fleetwing	Gregory	50	6.00	4.00	24	8.0	3.0	.96
10	Blue Beauty	* Henderson	50	8.00	5.00	40	9.0	4.6	1.4
11	Budlong	Leonard	52	6.80	5.01	34	9.55	3.5	1.3
12	Charmer	Vick	66	12.94	4.90	64	7.0	4.5	1.8
13	Chelsea	* Henderson	56	6.40	4.04	26	8.0	4.2	1.0
14	Clipper	Rawson	52	4.37	4.05	17	8.0	3.0	.7
15	Delicious	Gregory	72	5.30	5.45	29	8.25	4.0	.87
16	Don	* Henderson	66	5.08	5.44	22	10.5	6.0	1.1
17	Dwarf Sugar	* Henderson	69	5.20	5.50	28	8.5	4.0	.9
18	Earliest and Best	* Salzer	54	5.56	5.08	28	6.75	4.0	.75
20	Early Prize	Maule	54	7.78	4.50	35	8.4	4.0	1.3
21	Epicure	* Henderson	63	8.81	4.36	38	7.25	4.75	1.25
22	Everbearing	* Burpee	72	7.81	4.08	31	9.0	4.25	1.4
23	Favorite	* Gregory	69	5.30	4.64	25	7.0	3.75	.74
24	Fillbasket	* Henderson	63	9.20	5.50	51	6.0	4.75	1.1
25	First	* Henderson	50	5.60	5.12	29	9.1	5.14	1.02
26	First and Best	* Leonard	52	2.94	3.88	11	7.5	4.5	.43
27	Forty Fold	* Landreth	69	10.61	5.48	58	7.5	5.	1.6
28	French Canner	Landreth	58	8.40	6.32	53	8.0	4.25	1.35
29	Gladiator	Henderson	70	6.94	6.01	42	14.25	6.75	1.98
30	Hancock	* Gregory	50	4.78	5.78	26	8.5	3.75	.85
31	Heroine	Henderson	74	10.62	6.52	69	14.5	7.5	3.08
32	Kent	* Ferry	69	11.00	6.14	68	7.12	4.5	1.07
33	Kentish Invicta	Ferry	60	4.49	5.54	25	6.12	4.25	.55
34	Lightning	* Hallock	50	5.13	5.76	29	10.12	4.75	1.04
35	Major	* Henderson	75	8.14	4.52	35	13.75	7.5	2.24
36	Marblehead Marrowfat	Gregory	72	4.70	4.48	21	11.0	5.5	1.03
37	Market Garden	* Henderson	72	6.68	4.49	30	5.65	3.15	.75
38	Market Pride	* Burpee	70	5.61	3.58	19	8.0	4.25	.90
39	Marvel	* Burpee	70	7.36	4.56	33	7.9	4.9	1.16
40	McLean	* Henderson	69	7.21	4.92	36	8.2	5.0	1.18
41	Midsummer	* Henderson	68	5.63	3.56	19	7.5	5.0	.84
42	Morning Star	* Hallock	50	4.16	4.48	19	7.25	3.12	.65
43	Mummy	?	50	4.18	5.40	22	9.5	4.75	.86
44	Nott's Excelsior	Faust	54	4.03	5.20	21	9.25	5.5	.74
45	Prince of Wales	Gregory	70	9.58	4.16	40	9.25	5.25	1.77
46	Profusion	Salzer	69	5.60	5.42	30	9.75	4.25	1.09
47	Profusion	* Burpee	69	10.83	4.36	47	9.5	4.87	2.05
48	Quantity	* Burpee	67	11.63	4.26	49	9.25	4.75	2.15
49	Rural New Yorker	* Root	57	6.60	6.30	63	5.5	3.5	.73
50	Stanley	Burpee	70	10.07	5.32	54	9.75	5.25	1.96
51	Stratagem	* Gregory	66	14.75	4.62	68	12.5	6.75	3.69
52	Universal	Childs	67	6.42	5.20	33	8.4	4.0	1.07
53	Morning Star	Buist	48	3.00	5.66	17	7.0	3.25	.42
54	No. 4 Dwarf	Hicks	53	4.75	3.92	13	6.25	3.5	.66
55	Cable	Hicks	74	4.00	4.60	18	8.4	4.0	.67

* Grown from College seed.

Of the new varieties, the following are of some promise:

Budlong—Leonard. This is a strain of the First and Best or Extra Early sorts, of which it is the most productive, this season.

Charmer—Vick. Vines five feet high, and dark green. Pods rather short, broad, and somewhat curved. Peas white, smooth, and large. Season same as the Don and Admiral. It is very productive, but the pods are not very well filled, yet it is a very desirable pea.

Stanley—Burpee. Vines thirty inches high, with strong, stocky growth. Pods long, medium width and well filled. Peas white, wrinkled and large. Season same as the Abundance. It is a very promising variety.

Gladiator—Henderson. Vines forty-two inches high. Pods long and large. Peas are green, large, and smooth. Season the same as the above. Pods are extremely large and not always well filled, so the proportion of shelled peas is not large. A productive variety of the latest season.

No. 4 Dwarf and *Cable*—Hicks. These varieties were received too late in the season to be planted at the same time as the rest. The hot weather injured them too much to get an idea of their merits.

Quantity. Vines thirty inches high. Pods long, slim, numerous, and only moderately well filled. Season two days later than the Don.

Heroine has now for two years proved valuable. Season late. Vines three feet high. Pods long, numerous, and this year well filled.

VARIETIES RECOMMENDED FOR PLANTING.

Any of the early varieties will do for the first of the season, as there is very little difference between the strains.

Following these, in a few days, are the *Chelsea*, *Kent*, and *Blue Beauty*.

The *Chelsea* is quite dwarfed. Vines twelve inches high. Pods medium length, and only fairly well filled. Quality good. Rather unproductive.

Blue Beauty. Vines two feet high. It is more productive and the pods are better filled than the Chelsea.

Kent is about the same season, and very productive of peas of excellent quality, but the vines grow about four feet high, while the peas are very small size. Desirable for its quality.

Advancer is several days later than the preceding three varieties, and is more desirable. Vines thirty inches high. Pods of medium length, numerous, and well filled.

Stratagem. Vines thirty inches high. Pods three inches long, very abundant, and fairly well filled. Peas white, wrinkled, and medium large. Season the same as the Don. This comes at a season when varieties are scarce, and is the most prolific variety of any in the list.

PEPPERS.

Owing to the wet spring, the peppers were not transplanted until late in the season. Few varieties ripened fruit before time of frost. The table is therefore omitted. The following brief notes may be of use to those who wish to make a selection for garden planting.

Chili and *Coral Gem* bear small, tapering fruits of a bright red color. These varieties are the ones usually grown for use in condiments or sauces.

Cardinal and *Long Red* have larger and longer fruits of a less pungent flavor than the preceding and are largely used for pickles. *Large Bell* and *Ruby King* have large, short fruits of dark red color; flesh thick and of mild flavor. The *Squash* pepper is very productive and free from rot. The fruits resemble a tomato in shape and color. A good variety to grow.

County Fair Henderson. New. Plants medium in growth. Peppers 1½ inches in diameter at base. 4 to 5 inches long, tapering to a blunt point, smooth, uniform in size. Plants very productive, but did not ripen fruit.

SQUASHES.

The squashes were planted June 13, in hills eight feet apart each way. The soil was a sandy loam and well manured. The following varieties have not been described in former bulletins:

Butman—Gregory. Vines are not of vigorous growth, or very productive. Squash small to medium in size; light green, mixed with white; flesh thick, lemon color and of best quality. Late. A good keeper.

Dunlap's Marrow—Gregory. Vines strong, vigorous, and productive. Squash dark orange-yellow, similar to Hubbard in shape. Matures early and of good quality. One of the best for fall use.

Marblehead—Gregory. Vine a vigorous grower, moderately productive. Fruit of medium size, similar to Hubbard, but apex shorter, straight; color bluish-gray; shell very hard; flesh dry and of best quality. One of the best winter squashes.

Sweet Nut—Dreer. Vine vigorous; fairly productive. Squash small to medium in size, creamy white color; flesh of fair quality. A good fall variety.

The following list which includes many well-known varieties is recommended for the purpose named:

For summer use—Strickler Summer and Bush Scallop.

For fall use—Dunlap's Marrow and American Turban.

For winter use—Hubbard, Marblehead, and Pike's Peak.

Cocoanut and Fordhook are excellent small squashes for fall and early winter use. The plants will produce a good crop, when the larger varieties fail.

TOMATOES.

The seed was sown in the forcing-house March 24. The plants were placed in the field June 7. Six plants of a variety were used for a test. From two plants in each set, the fruits were picked and weighed as they ripened. After the vines were killed by frost, the green tomatoes, remaining on the two plants mentioned, were counted and weighed. In this way the comparative productiveness of the several varieties was ascertained. In the table, not all the varieties grown are given. Only the new varieties, together with some of the older and better sorts, are tabulated.

EXPLANATIONS OF TABLE.

The first column gives the date when the first tomatoes of the variety ripened. The second column records the number and weight of ripe fruits picked from two plants during the season. In the third column the average weights of the ripe tomatoes are given. The next two columns contain the number and weight of the green tomatoes picked from the two plants at time of frost. In the last two columns is given the total amount of fruit produced by the two plants.

TABLE NO. 8.

Number.	Variety.	Seedsman.	Date first ripe fruits.	Number ripe.	Weight in lbs.	Average weight of ripe fruits.—oz.	Number green.	Weight in lbs.	Total number.	Total weight.
103	Acme	Gregory	Aug. 30	268	86	5+	84	13½	352	99½
107	Beauty	Rawson	Aug. 24	183	56	5—	264	47	447	103
109	Climax	Rawson	Aug. 30	314	73¼	4—	39	10¼	353	83½
114	Optimus	Ferry	Aug. 30	159	47⅞	5 -	162	32½	321	80⅜
124	Golden Queen	Rawson	Sept. 1	182	64	6—	200	41¼	382	105¼
154½	Ignotum	College	Aug. 27	152	52½	6—	219	58¼	371	110¾
161	Potato Leaf	Livingston	Sept. 12	165	68	7—	150	39¼	315	107¼
188	Earliest	Vaughan	Aug. 19	383	83⅝	3+	14	1¼	397	85⅛
195	Turner	Maule	Aug. 29	136	61	7+	214	59¾	349	120¾
196	Volunteer	Dreer	Aug. 22	111	46	7—	170	41¾	281	87¾
197	Nichols Stone	N. & S.	Aug. 30	148	61¼	7—	171	46¾	319	108
198	Perfection	Livingston	Aug. 28	185	80½	7—	326	29½	511	110
201	Atlantic	J. & S.	Aug. 30	118	43½	6—	118	21	236	64½
203	Cumberland Red	J. & S.	Aug. 29	176	67¼	6	115	25	291	92¼
212	Table Queen	Henderson	Sept. 2	119	60½	8+	89	27¾	208	88¼
217	Long-keeper	Thorburn	Aug. 30	255	94⅝	6—	275	42	530	136⅝
219	Mitchell	Gregory	Sept. 1	102	33¾	5+	330	59¼	432	93
222	Ponderosa	Henderson	Sept. 19	15	13¾	14+	167	55¾	182	99½
223	Early Ruby	Henderson	Aug. 30	256	93⅜	6—	73	16	329	109⅜
226	Nicholson	Nicholson	Sept. 2	220	49½	4—	106	10	326	59½
229	Cardinal	Vaughan	Sept. 9	71	26	6—	116	28¼	187	34¼
230	Balt. Prize Taker	Landreth	Aug. 30	78	27½	6+	66	15	144	42½
231	Money Maker	Landreth	Aug. 30	162	51	5+	38	7½	200	58½
232	Ten Ton	Landreth	Aug. 30	84	22¾	4+	142	27¾	226	50½
233	Earliest of All	Maule	Aug. 28	100	29¾	5—	65	15½	165	45¼
234	Mansfield Tree	Leonard	Sept. 12	17	13½	13—	98	38¾	115	52¼
235	Telegraph	Salzer	Aug. 30	202	55⅞	4+	55	9¼	257	65⅛
242	Golden Sunrise	Henderson	Sept. 12	114	42¼	6—	392	47	506	89¼
244	Dwarf Champion	Harris	Aug. 20	72	19¾	4+	175	28	247	47¾
246	Potomac	Harris	Sept. 3	250	84¼	7—	197	29¾	447	114
248	McCollum's Hybrid	Harris	Sept. 2	66	34½	8+	205	53¼	271	87¾
249	Potato-leaved Ignotum	College	Sept. 12	142	82¾	9+	90	26½	232	109¼
250	Picture Rock	Childs	Aug. 29	168	58½	6—	182	32½	350	91
251	Climbing	Childs	Sept. 2	78	37¼	8—	172	51½	250	88¾
252	Majestic	Buist	Sept. 12	150	55	6—	235	44¼	385	99¼
253	Prize Belle	Buist	Sept. 12	132	44½	6—	228	51½	360	96

As in former seasons, the *Earliest*, from Vaughan, was the first to ripen fruits. It is medium in size, slightly angular, quite firm, and of good quality. Nearly all of the fruits ripened before frost.

Volunteer and *Beauty* were next to ripen fruits, but only a few ripened early. The bulk of the crop was much later.

Early Ruby and *Cumberland Red* followed in a few days. The plants of Early Ruby are strong and very productive; fruits of medium size, somewhat angular, bright red color and of good quality. Valuable as an early variety. Cumberland Red is also a good variety.

Of the recent pink varieties, Long-keeper and Potomac confirmed the good report of last year.

The plants are productive, fruit of good size, regular form, and moderately firm. Of the older pink sorts, Beauty and Acme gave good satisfaction. Golden Queen is as good as any of the yellow-fruited varieties.

Ignotum still leads among the red varieties, but some of the pink sorts exceed it in productiveness.

Perfection is one of the best red sorts.

Ponderosa. The season is very late. From a patch of over one hundred plants we did not get a single fruit which ripened thoroughly on the vines. The tomatoes would crack and rot before ripening. To get good specimens it was necessary to pick them green, and ripen in the house. The fruit when well ripened is of good quality.

Dwarf Champion ripened a few fruits early, but the larger part of the crop did not mature before frost. The fruit is very attractive in appearance, but its fault of not ripening earlier is a serious one.

The following are sorts of recent introduction:

Cardinal—Vaughan. This is not a new variety, but has not been grown at the college for several years. Plants strong and vigorous; fruit large, smooth, somewhat flattened; flesh firm. A good shipper, but not of first quality.

Baltimore Prize Taker—Landreth. Plants of strong, spreading growth; foliage large, dark green; fruit large, spherical, slightly ribbed, light red with purple tint; flesh solid and of fair quality.

Money Maker—Landreth. Plants of medium growth, somewhat lacking in foliage; fruit large, angular in shape, somewhat flattened, bright red color, many celled and seeds numerous; flesh lacking in solidity but of good quality.

Maule's Earliest—Maule. Plants are of small growth; foliage small. The type of the fruit varies, some fruits are nearly spherical in shape, others are angular. The angular type is early, 2½ to 3½ inches in diameter, irregular in shape around the stem, but smooth enough to sell; bright red in color; flesh solid and of fair quality. Does not come up to description in catalogue. Later by ten days than Earliest from Vaughan.

Mansfield Tree—Leonard. Plants strong and vigorous; leaflets rather large, dark green; fruit 4 to 5 inches in diameter; usually ovate and irregular in shape; flesh walls very thick; cells small and contain few seeds. The fruit ripens very slowly and seldom colors all over. The plant has a tendency to upright growth, but it can not be called a tree tomato. Closely resembles Ponderosa, but the plant is of more upright growth, fruit smaller, more regular in form, and ripens better.

Telegraph—Salzer. Plants of medium growth, lacking in foliage; fruit 2½ to 3½ inches in diameter, somewhat flattened, often quite angular and irregular in shape, still it will sell well. The plants ripened nearly all the fruit before frost. Resembles Earliest, from Maule.

Potato-leaved Ignotum—College. Plants low-growing, but vigorous; foliage potato-leaf; fruits resembles Ignotum in color and shape, but are larger. Ripens later than Ignotum.

Climbing—Childs. Plants very strong-growing and healthy, showing a tendency to climb; fruit large, somewhat irregular at stem end, pinkish-purple in color, resembling closely the fruit of Potato-leaf.

The following sorts differ but slightly from Ignotum:

Majestic—Buist. The fruit is darker and brighter red than Ignotum, and ripens later.

Prize Belle—Buist. Closely resembles preceding, but plants are not so strong-growing.

Ten Ton Tomato—Landreth. The plants are not so strong-growing as Ignotum, and the fruit has a yellowish tinge.

Picture Rock—Childs. Very closely resembles the Ten Ton, differing slightly in growth and color of fruit.

We received seeds of some of the leading varieties of tomato from Berthoud of Australia, also from Joseph Harris of Moreton Farm, N. Y.; these were planted near the same varieties grown from seeds of our own selection.

The tomatoes grown from the Australian seed were more uniform and regular in shape, and the plants slightly more productive than the same varieties grown from American seed. Between those grown from seed obtained from Harris, and our own seed, no difference was noted.

POTATOES.

TEST OF VARIETIES.

The manner of carrying on this test was the same this year as in previous years, two pounds of seed being used to thirty-three feet of row. The rows are three feet apart and the hills one foot apart in the row.

The planting was done on May 20. The soil was of fair fertility. The previous year the land was in millet. The tubers were partially grown when the drought and hot winds of August stopped further growth and the crop ripened. Those varieties that set few potatoes yielded a larger per cent. of merchantable tubers, and the varieties that set many tubers and are usually the better yielders were generally unable to mature the crop, hence a large per cent. were undersize. For this reason, only the total yield is given.

Some of the varieties have been on trial for several years, and for comparison the average yield is included for the number of years that they have been on trial.

All varieties of which the average yield is less than 100 bushels are dropped from the list.

Those seedsmen whose name is marked with a * furnished the seed to us previous to the past year, and the crop of 1892 was grown from the college seed.

The abbreviations used in the description of the tubers are as follows:

TABLE No. 9.—POTATOES.

Color.		Form.		Eyes.		Curtain.	
						(The ridge over the eyes.)	
b.	buff.	f.	flattened.	d.	deep.	i.	indistinct.
d.	dark.	i.	irregular.	m.	medium.	l.	long.
l.	light.	l.	long.	n.	numerous.	m.	medium.
p.	pink.	ob.	oblong.	s.	shallow.	s.	short.
pur.	purple	ov.	oval.				
r.	red.						
w.	white.						

Varieties.	Seedsmen.	Growth of vines.	Date of ripening.	Yield, 1893.	Average yield.	No. of years for which the av. yield is taken.	Description of the tubers.			
							Color.	Form.	Eyes.	Curtain.
Alaska	* Alexander	17, sp.	Aug. 16	53.	166	4	w	r	s	i
Albino	* Vaughan	20, sp.	" 12	121.9	135	3	w	i ob	s	i
American Wonder	Vick	19, sp.	" 26	103.7	103	1	w	ob	m	m
Arizona	* Vaughan	18, up.	" 25	64.7	107	3	r	l f	s	l
Bannock	* Herrington	20, up.	" 30	50.2	210	4	r	l	s	m
Barstow	* Markham	17, sp.	" 12	120.	160	2	l p	ob	m	m
Beauty of Hebron	* Jerrard	18, sp.	" 10	185.	157	4	l p	ob	m	m
Ben Harrison	* Crawford	16, up.	" 12	76.	106	3	l p	l	m	m
Bliss No. 12	* College	17, sp.	" 16	43.6	112	3	l p	ob	m	d
Boley's Northern Spy	* Vaughan	19, sp.	" 20	96.	117	2	r	ob	d	l
Bonanza	* Markham	20, up.	" 16	74.8	100	2	d r	l	d	l
Boston	Salzer	18, up.	" 18	137.1	137	1	l p	ob	m	m
Brownell's Best	* Vt. Ex. Sta.	18, up.	" 20	115.9	162	4	w	ob	s	l
Brownell's Winner	* Burpee	22, sp.	" 24	88.	157	3				
Burpee's Ex. E'y	* Burpee	12, up.	" 12	95.5	125	3	l p	l	m	d
Chautauqua	* Presley	19, sp.	" 20	125.	193	2	r	l	d	l
Clark's No. 1	* Vt. Ex. Sta.	18, up.	" 18	125.9	190	5	b	ob	m	m
Copper Mine	* Herrington	18, sp.	" 24	104.8	203	4	p	ob	m	l
Cream of the Field	* Markham	16, sp.	" 24	160.3	124	2	b	ob	m	m
Cream City	Frogner	15, sp.	" 15	129.8	130	1	w	ob	s	m
Crown Jewell	* Markham	19, sp.	" 15	151.7	180	2	w	ob f	m	d
Dakota Red	* Vt. Ex. Sta.	17, up.	" 28	88.	226	4	d r	ob	d	m
Delaware	* Crawford	18, sp.	" 22	78.8	129	2	l p	ob	m	m
Dictator	* Vt. Ex. Sta.	17, sp.	" 19	55.	172	4	w	ov f	m	l
Early Harvest	* Crawford	17, sp.	" 15	97.1	183	4	p	ov	s	i
Early Maine	* Jerrard	18, sp.	" 15	111.3	131	4	p	ov	s	i
Early Mayflower	* Henderson	14, sp.	" 25	69.6	111	2	p	ov	m	l
Early Minnesota	* Presley	17, sp.	" 18	109.9	174	2	p	ov	m	s
Early Oxford	* Gregory	17, sp.	" 15	115.	221	4	l p	ob	m	m
Early Pearl	* Markham	17, sp.	" 20	221.3	208	2	p	ov	m	l
Early Puritan	* Jerrard	19, up.	" 18	180.4	173	2	p	ob	m	l
Early Rose	* Jerrard	19, up.	" 18	180.4	190	3	p	ov	m	s
E'y 6 Weeks Market	* Presley	17, up.	" 7	140.	153	2	p	r	m	m
Early Vermont	* Jerrard	20, sp.	" 28	188.	233	3	p	ob	d	l
Empire State	* Jerrard	22, up,	" 28	121.	180	4	p	ob	m	m
Everitt	* Vt. Ex. Sta.	22, sp.	" 20	120.4	201	3	d r	l	s	l
Excelsior	* Vt. Ex. Sta.	18, sp.	" 10	97.7	196	4	l p	l	m	m
Farina	* Markham	17, sp.	" 22	95.7	114	2	b	v l	s	i
Farmer's Alliance	Landreth	18, sp.	" 22	128.	128	1	p	ob	m	m
Faust's 1889	* Faust	18, sp.	" 18	95.9	184	2	p	ov	m	l
Fearnaught	* Markham	19. up.	" 18	128.8	152	2	p	ob	m	m
Feek's Ex. E'y	* Vaughan	17, sp.	" 8	104.5	152	3	l p	l	m	i
Fillbasket	Gregory	17, sp.	" 22	106.	106	1	l p	ob	s	l
Freeman	* Maule	18, up.	" 22	105.2	209	2	r	ob	d	m
Ft. Collins No. 83	* Col. Ex. Sta.	17, sp.	" 16	163.6	186	3	l p	ob	d	m
Gardner's Early	* Gardner	18, sp.	" 5	50.2	145	4	p	ov	l	s
Genesee Co. King	Jewett	17, up.	" 23	109.6	110	1	w	ov	m	m
Gov. Rusk	Salzer	18, sp.	" 24	121.7	122	1	p	ob	s	i
Green Mountain	* Vaughan	17, sp.	" 28	90.	109	3	r	o b f	m	s
Gregory No. 1	* Vt. Ex. Sta.	14, sp.	" 16	89.2	204	4	l p	l	m	m

POTATOES.—*Continued.*

Varieties.	Seedsman.	Growth of vines.	Date of ripening.	Yield, 1893.	Average yield.	No. of years for which the av. yield is taken.	Description of the tuber.			
							Color.	Form.	Eyes.	Curtain.
Gregory No. 2	* Vt. Ex. Sta.	17, sp.	Aug. 22	116.	141	3	l p	ov	m	m
Halo of Dakota	* Presley	20, up.	" 30	156.1	209	2	b	ob f	m	s
Hampden Beauty	* Markham	13, sp.	" 21	128.9	122	2	l p	ob	m	m
Hick's No. 9	D. C. Hicks	17, up.	" 15	109.	109	1	w	r	s	i
Hick's No. 12	* D. C. Hicks	17, sp.	" 12	217.8	184	2	l p	ob	s	m
Hick's No. 81	* D. C. Hicks	15, sp.	" 25	117.3	143	2	p	ob	d	d
Hick's No. 101	* D. C. Hicks	15, sp.	" 20	94.5	133	2	w	l f	s	i
Howe's Premium	* Howe	17, sp.	" 7	169.5	135	3	p	r	s	i
Ideal	* Crawford	18, up.	" 20	115.	164	3	r	r f	s	l
Imperator	* Crawford	23, up.	" 26	88.4	135	3	p	ob	m	m
Iowa Beauty	* Presley	19, sp.	" 15	226.8	191	2	l p	l	m n	m
Iron Clad	Salzer	17, sp.	" 16	108.9	109	1	p	ob	d	s
Jewell	Bessmer	19, sp.	" 19	125.	125	1	------	------	------	----
June Eating	* A. Crane	16, sp.	" 16	136.	203	3	p	ov	m	s
Koshkonong	Leonard	19, sp.	" 19	125.	125	1	w	l f	s	l
Lazell's Seedling	* Presley	19, sp.	" 20	163.9	229	2	r	ob f	d	l
Leather Coat	* College	17, up.	" 17	88.	194	3	p	ob	m	s
Lee's Favorite	* Vt. Ex. Sta.	15, sp.	" 13	156.5	223	4	p	ob	d	s
Matchless	* Presley	18, sp.	" 22	60.5	124	4	------	------	------	----
Mc Fadden's Earliest	* Presley	20, sp.	" 14	134.1	186	2	p	r f	d	l
Minnesota Seed No. 50	Frogner	18, sp.	" 18	176.	176	1	p	ov	d	l
Minnesota Seed No. 189	Frogner	16, up.	" 16	128.2	128	1	------	------	------	----
Minnesota Seed No. 190	Frogner	16, sp.	" 20	145.	145	1	------	------	------	----
Mitchell's Seedling	* Markham	17, up.	" 26	104.5	142	2	pur	ov f	s	i
Monroe's Seedling	* Farm Dept.	20, up.	" 19	164.2	204	2	l p	l	s	m
Mrs. Cleveland	* Vt. Ex. Sta.	16, sp.	" 16	166.3	238	2	p	ov	s	m
Nameless No. 1	* Farm Dept.	16, sp.	" 18	117.2	131	2	p	ov	s	m
New Queen	* Gregory	19, sp.	" 14	149.4	194	2	l p	ob	m	m
Nott's Victor	* Presley	22, up.	" 20	157.1	166	2	p	ob	m	m
Ohio Junior	* Crawford	18, sp.	" 16	121.	107	2	r	r	s	i
O. K. Mammoth	* Vt. Ex. Sta.	17, up.	" 20	92.2	130	2	w	ov f	m	l
Osceola Mammoth	Osceola Co.	16, up.	" 10	108.6	109	1	l p	ob	s	m
Paris Rose	Frogner	15, sp.	" 22	101.1	101	1	p	l	s	i
Park Region	Frogner	16, up.	" 20	108.2	108	1	l p	ob	d	l
Pearl of Savoy	* Markham	20, sp.	" 14	143.	144	1	p	ob	m	s
Peoples	* Hicks	15, up.	" 20	117.	141	2	l p	ov	m	m
Perfection	* Markham	18, sp.	" 20	109.2	173	2	l p	ob	m	m
Polaris	* Farm Dept.	18, sp.	" 20	127.6	139	5	l p	ob	s	m
Pres. Lincoln	* Gardner	17, sp.	" 17	74.5	222	4	r	r	m	l
Putnam's Early	* Vt. Ex. Sta.	20, sp.	" 12	163.	217	4	p	ov	m	l
Putnam's Select	* Vt. Ex. Sta.	18, sp.	" 19	82.5	160	4	------	------	------	----
Queen of Paris	* Presley	18, sp.	" 15	225.0	281	2	l p	ob	s	d
Queen of the Valley	* Presley	11, sp.	" 17	76.8	134	3	p	ob	m	l
Randall's Beauty	* Vt. Ex. Sta.	18, sp.	" 19	71.	169	4	w	ob	s	i
Red Star	* T. B. Main	19, sp.	" 14	84.	116	3	p	ob	s	i
Rochester Favorite	* College	17, sp.	" 15	96.	196	4	p	ob	m	m
Rochester Rose	Henderson	8, up.	" 8	128.1	128	1	p	ob	s	m
Roger's Seedling	* Hicks	17, sp.	" 15	227.	209	2	p	ob	d	s
Rose's 74	* Markham	16, sp.	" 24	26.2	105	2	p	ob f	d	l
Rural Blush	Vt. Ex. Sta.	18, sp.	" 19	128.2	216	4	p	ov	m	l
Rural New Yorker No. 2	* Thorburn	20, sp.	" 24	97.8	112	3	r	r i	m	m
Salzer's Earliest	Salzer	19, sp.	" 15	137.6	138	1	r	r f	s	i
Signal	* Presley	16, sp.	" 22	195.5	228	2	l p	ob	m	m
Snow Drop	Henderson	11, sp.	" 19	224.7	225	1	l p	ob	m	l
Snow Queen	* Markham	18, sp.	" 20	147.	111	2	p	ov	m	l
Star Russet	* Presley	20, sp.	" 28	986.	139	2	p	ov	m	l
Storr's Seedling	* Markham	18, sp.	Sept. 4	185.6	150	2	p	r f	m	m
St. Patrick	Henderson	18, sp.	Aug. 10	108.9	109	1	p	ob	s	i

POTATOES.—*Continued.*

Varieties.	Seedsman.	Growth of vines.	Date of ripening.	Yield, 1893.	Average yield.	No. of years for which the av. yield is taken.	Description of the tuber.			
							Color.	Form.	Eyes.	Curtain.
Stray Beauty	* Jerrard	18, sp.	Aug. 10	108.9	102	3	r	r	s	i
Summit	* E. E. Stine	15, sp.	“ 22	55.	256	4	r	ob	s	i
Sunlit Star	* Markham	15, sp.	“ 15	145.2	159	2	r	ob	m	m
Superior	* Burpee	22, up.	“ 15	92.	159	4				
Supplanter	* Presley	20, sp.	“ 15	135.6	221	2	p	ob	s	s
Sylvan	* Markham	20, sp.	“ 17	143.	106	2	p	ob f	m	l
Thorburn	* College	16, sp.	“ 14	103.6	205	4	lp	l	m	m
Timpe's No. 2	J. T. Timpe	17, up.	“ 30	131.3	124	2	p	ob	m	m
Timpe's No. 4	J. T. Timpe	17, sp.	“ 16	234.9	197	2	p	l	m	m
Timpe's No. 5	J. T. Timpe	19, up.	“ 31	170.	130	2	p	ob	m	l
Timpe's No. 6	J. T. Timpe	14, sp.	“ 16	138.9	153	2	p	ov	m	m
Tonhocks	* Markham	17, sp.	“ 20	174.	194	2	r	r	m	l
Triumph	Henderson	16, sp.	“ 12	181.5	182	1				
Umpire	* Presley	15, sp.	“ 30	107.7	198	2	l p	ob	d	m
Wall's Orange	* Farm Dept.	14, sp.	“ 20	57.8	108	2	r	r f	m	m
Watson's Seedling	* Farm Dept.	16, sp.	“ 20	164.8	159	2	p	ob	m	l
Way	* Presley	21, up.	“ 22	121.9	153	2	w	ob	s	i
West's No. 1	* W. E. West	16, sp.	“ 11	143.5	168	2	p	ob	m	l
West's No. 2	* W. E. West	14, sp.	“ 10	98.9	111	2	l p	ob	m	m
West's No. 3	* W. E. West	15, sp.	“ 18	133.5	199	2	p	ob	m	l
White Elephant	* Jerrard	20, up.	“ 20	120.	164	2	l p	ob	m	m
White Flower	* Markham	17, up.	“ 20	126.9	148	2	l p	ob	m	m
White E'y Ohio	* Presley	16, sp.	“ 14	140.	175	2	w	ob f	s	m
White Star	* Farm Dept.	21, up.	“ 20	113.	139	2	w	ob	s	i
Wixom's Seedling	*VanBenschot'n	15, sp.	“ 18	62.3	117	3	l p	ob	s	l
Vick's Champion	Vick	18, sp.	“ 25	132.	132	1	w	ob	m	l

The following are brief descriptions of the new varieties:

American Wonder. Strong, vigorous, upright grower. Season late. Unproductive this year. Tubers slightly longer than broad, somewhat flattened. Eyes and curtain medium. Flesh rich cream.

Boston. Strong, upright growth. Season medium, fairly productive. The tubers resemble the White Elephant. Flesh light cream.

Cream Ctiy. A spreading, medium grower. It sets many tubers, but the yield is only fair. Tubers kidney-shape to oblong. Eyes shallow. Flesh medium cream.

Farmer's Alliance. Top large, spreading. Season late. Fairly productive. Tubers many, small, oblong. Eyes shallow. Color pink.

Fillbasket. A medium, spreading grower. Season late. Vines blighted August 15 and the yield was reduced. Tubers oblong, regular. Skin rough. Eyes shallow. Curtain long, arched. Flesh light cream.

Genesee Co. King. A fairly upright grower. Suffered from the blight. Tubers white, oval, and of fine appearance.

Gov. Rusk. A good, spreading grower. Productiveness only fair.

Hicks No. 9. A good, upright grower, foliage tough and shunned by the beetles. Yield only fair. Tubers of good appearance, white. Skin smooth. Eyes indistinct.

Iron Clad. Growth spreading; season medium. Only fairly productive.

Koshkonong. Vigorous, spreading grower. Only fairly productive. Tubers rather long and somewhat flattened. Color white. It is of good appearance.

Minnesota Seedling No. 50. A spreading grower of medium vigor. Season medium. A good yielder of desirable quality. From S. Frogner, Herman, Minn.

Minnesota Seedling Nos. 189 and 190 are seedlings from the same source, but not so productive.

Osceola Mammoth. A variety from Osceola county. Something like the Early Rose, but it is a week earlier. The vines set but few tubers, all of which were of good size.

Park Region. Vines of medium growth. Sets many potatoes, but the yield was hurt much by the drought. Tubers somewhat like the Beauty of Hebron, only the eyes are much deeper. Season, medium to late.

Rochester Rose. Vines made a very poor growth. Season very early. Vines killed by the heat, and potatoes all small. In a more favorable season it would probably be a good yielder. Tubers similar to the Early Rose.

Salzer's Earliest. Vines thrifty. Season, early to medium. It set many tubers, and all were even-size, but small this season.

Tubers round, flattened and red in color, which is an objection in an early potato.

Snow Drop. Poor growth of vines. Season, medium. Very productive. Tubers oval, even in size, and somewhat like the Beauty of Hebron.

Triumph. Medium strong grower, spreading habit. Season nearly a week earlier than the Early Rose. Quite productive.

Vick's Champion. A medium strong, spreading grower. Season, late; only fairly productive. Tubers class with the White Elephant.

The following are varieties tried by us for the first time this year that have done poorly, the trial of which will be continued:

Bill Nye,
Blue Mayflower,
Carpenter's Seedling,
Chas. Downing,
Charter Oak,
Early Wisconsin,
Geo. H. Price,
Hicks No. 22,
Hicks No. 60,
Hoffman,
Home Comfort,
Late Puritan,
Minnesota Seedling No. 18,
Minnesota Seedling No. 64,
Negro,
Ontop,
Pride of the West,
Prize Taker,
Restaurant,
Stanley,
White Chief,
Vanguard.

WHAT VARIETIES TO PLANT.

Extra Early.

Howe's Premium is among the earliest varieties to ripen and is the best one of this season.

Early Six Weeks Market is equally as good, but generally a few days later than the first variety named.

Early.

Queen of Paris is the most productive variety of the list at this station for the two years that it has been raised. *Lee's Favorite, Early Oxford, Putnam's Early, Iowa Beauty, McFadden's Earliest*, and *Thorburn* are valuable.

Medium Season.

Mrs. Cleveland, formerly known as *Nott's No. 8, Snow Drop, Pres. Lincoln, Supplanter, Early Pearl, Gregory No. 1* and *June Eating* are the best of this class.

Late.

Summit is especially recommended; *Signal, Lazell's Seedling, Dakota Red, Bannock*, and *Halo of Dakota* are the best late sorts.

FERTILIZER TESTS.

The tests of fertilizers upon potatoes were the same as in the season of 1891, using the same plots and the same fertilizers for the first twenty plots.

Each plot is one rod wide and four rods long and contains four rows of potatoes. The rows are three feet apart, thus leaving seven and one half feet space between the nearest rows of adjacent plots. This space is occupied by young pear trees.

Plots twenty-one to twenty-four were in potatoes in 1891, but did not have any special treatment.

Four plots are in a row, thus —plot two is alongside of plot six, etc.

The fertilizers were applied in the row both above and below the seed.

The planting was done on May 27, and the digging and weighing was commenced on September 8.

TABLE No. 10.—*Fertilizer Tests.*

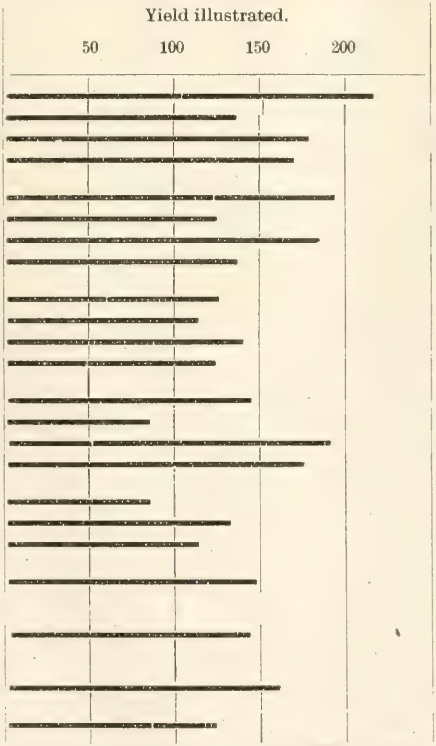
Plot.	Fertilizer.		Yield per acre.—Bushels.					
			O. K. Mammoth.	Rochester Favorite.	Timpe's No. 2.	Watson's Seedling.	Average 1892.	Average 1891.
I.	Mulch between rows		234.6	124.2	89.5	178.1	156.6	262.6
II.	Nothing		145.4	67.8	51.3	146.0	102.6	166.9
III.	4 lbs. sulphate ammonia 10 lbs. ground bone 6 lbs. muriate potash	Under seed	144.1	93.5	98.9	183.3	130.0	221.2
IV.		Over seed	171.3	136.3	95.7	127.3	132.6	196.3
V.	Manure	Under seed	234.0	201.0	126.7	130.8	173.2	219.1
VI.	Nothing		103.0	49.5	61.0	79.0	73.1	170.6
VII.	4 lbs. sulphate ammonia 10 lbs. ground bone 6 lbs. sulphate potash	Under seed	206.2	167.2	107.1	145.7	156.5	216.2
VIII.		Over seed	108.2	128.5	74.1	64.6	93.8	171.9
IX.	1 bushel wood ashes	Under seed	57.9	57.0	116.2	91.0	80.5	163.0
X.	Nothing		46.2	35.4	45.8	91.8	54.8	172.2
XI.	6 lbs. nitrate soda 10 lbs. ground bone 6 lbs. sulphate potash	Under seed	115.0	80.7	96.5	91.9	96.0	184.9
XII.		Over seed	114.0	78.4	80.6	112.6	96.5	143.1
XIII.	Manure	Over seed	129.3	103.5	58.0	132.7	105.9	188.8
XIV.	Nothing		78.2	47.6	20.0	59.5	51.3	128.9
XV.	10 lbs. ground bone 6 lbs. sulphate potash	Under seed	205.9	161.3	70.1	165.7	150.0	231.0
XVI.		Over seed	186.2	139.2	95.5	183.1	156.0	199.3
XVII.	Nothing		39.0	58.5	13.1	71.5	45.5	115.4
XVIII.	6 lbs. sulphate potash	Under seed	68.9	49.5	25.1	115.5	64.7	194.4
XIX.	6 lbs. sulphate potash	Over seed	27.4	69.3	17.5	77.5	47.9	190.4
XX.	6 lbs. nitrate soda 10 lbs. ground bone 6 lbs. muriate potash	Under seed	162.2	110.2	40.4	113.7	114.1	186.0
XXI.	4 lbs. sulphate ammonia 10 lbs. dissolved bone-black 6 lbs. muriate potash	Under seed	125.8	115.8	52.2	116.4	102.5	178.2
XXII.	4 lbs. sulphate ammonia 10 lbs. dissolved bone-black	Under seed	165.6	109.7	55.8	159.7	122.4	198.2
XXIII.	10 lbs. dissolved bone-black 6 lbs. muriate potash	Under seed	139.6	118.0	31.7	102.3	105.4	147.2
XXIV.	Nothing		100.8	107.5	27.0	99.6	83.7	-----

The yields on all of the plots are less this year than last year. This is due more to the season than to the exhaustion due to the raising the same crop on the same ground two years in succession, although some of the plots show that certain elements are partially exhausted.

Fertilizers under the seed produced the best results in 1891, and in 1892 fertilizers over the seed did the best. The different conditions of the two years explain the difference. This past season was very wet, and the plant food was carried down to the roots, and as the plots had the same fertilizers applied the previous year, the food elements remaining unused in the soil were not all above or all below the seed, but thoroughly mixed with the whole body of the soil. So the plots with the fertilizers applied above or below the seed do not represent this one condition exactly, but from the position of the feeding roots of this potato, we advise using the fertilizer under the seed.

The yields of the different plots compared with each other is about the same this past season as in 1891; so for convenience of further study the yields of the two years are united in the following table.

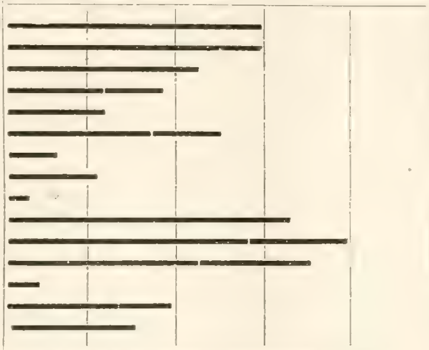
TABLE NO. 11.—*Yields of fertilizer plots, bushels per acre—Average for two years.*



Plot.	Yield.	Treatment.
I.	209.6	Mulch.
II.	134.7	Nothing.
III.	175.6	4 lbs. sulphate ammonia. 10 lbs. ground bone. 6 lbs. muriate potash.
IV.	164.4	
V.	196.1	Manure.
VI.	121.8	Nothing.
VII.	186.3	4 lbs. sulphate ammonia. 10 lbs. ground bone. 6 lbs. sulphate potash.
VIII.	132.8	
IX.	121.7	1 bu. wood ashes.
X.	113.5	Nothing.
XI.	140.4	6 lbs. nitrate soda. 10 lbs. ground bone. 6 lbs. sulphate potash.
XII.	119.8	
XIII.	147.3	Manure.
XIV.	90.1	Nothing.
XV.	190.5	10 lbs. ground bone. 6 lbs. sulphate potash.
XVI.	177.6	
XVII.	80.4	Nothing.
XVIII.	129.5	6 lbs. sulphate potash.
XIX.	119.1	
XX.	150.	6 lbs. nitrate soda. 10 lbs. ground bone. 6 lbs. muriate potash.
XXI.	140.3	4 lbs. sulphate ammonia. 10 lbs. dis. bone-black. 6 lbs. muriate potash.
XXII.	160.3	4 lbs. sulphate ammonia. 10 lbs. dis. bone-black.
XXIII.	126.3	10 lbs. dis. bone-black.

In examining the yields in detail, attention is called to the fact that each row contains a nothing plot. Observe that the yields of these nothing plots decrease gradually from the first until the last. The soil in each row seems to be very uniform, and the nothing plot of that row should be used as a base of comparison for the plots of that row, and to compare the plots of different rows it should be done by comparing the gains of the plots over the nothing plots of those rows. The following table shows the gain of the fertilized plots over the nothing plots.

TABLE NO. 12.—*Gain per acre in bushels of fertilizer plots over nothing plots.*

Plot.	Gain.	Gain illustrated. 25 50 75 100	Treatment.
I.	74.9		Manure.
V.	74.3		
XIII.	57.2		
III.	40.9		Complete fertilizer.
IV.	29.7		
VII.	64.5		
VIII.	11.0		
XI.	26.9		
XII.	6.3		
XX.	79.6		
XV.	100.4		Ground bone and potash.
XVI.	87.5		
IX.	8.2		Ashes.
XVIII.	49.1		Potash.
XIX.	38.5		

The action of the mulch was not as beneficial this season as in 1891. It held the moisture when the ground was too wet already. The plots treated with manure presented a very thrifty appearance during the whole season. They seemed to rid themselves of the surplus water in June, and they stood the drought well in August. The yield of plot XIII was not so large as the appearance of the vines would indicate.

The difference between the treatment of plots III and IV from that of plots VII and VIII is that the former contain muriate of potash and the latter sulphate of potash. The latter two average 2.4 bu. per acre more than the former, which is not enough difference to form a definite conclusion, but as the sulphate is cheaper than the muriate, its use would be more economical. Plots VII and VIII differ from plots XI and XII in regard to treatment, in that the former contained sulphate of ammonia, and the latter nitrate of soda. The gain of the former two over the latter two is 21.1 bu. per acre, which tends to prove the superiority of sulphate of ammonia over nitrate of soda. Plot XX has the nitrate of soda combined with the muriate of potash instead of the sulphate of potash, as in plot XI (plot XX has the fertilizer applied under the seed hence it can be compared only with plots that have the fertilizer applied likewise). It has been previously shown that muriate and sulphate of potash produce nearly similar results. If this is true plots XI and XX should show the same gain, but there is 52.7 bu. per acre difference in their gain over their nothing plot which shows that the trials are not carried far enough yet to draw definite conclusions. Plots XV and XVI treated to ground bone and sulphate of potash have produced better results than the same fertilizers with nitrate of soda added, as in plots XI and XII, or with sulphate of ammonia added, as in plots VII and VIII, which seems to show that a fertilizer rich in nitrogen is an injury to the potato crop. This point should be more thoroughly investigated.

Our experiments and those of others[1] have led to the following conclusion, *that on fairly rich soil the addition of nitrate of soda or sulphate of ammonia to bone and potash is done at a financial loss if not at a reduction in yield.*

Plots XVIII and XIX with potash alone gave a very profitable increase over the nothing plot in 1891, but it had much less effect in 1892, although there was still an increase. Comparing these two plots with plots XV and XVI in the first table of fertilizer tests, it will be seen that potash alone increased the yield to within 9.6 bu. per acre, as much as the potash and bone combined, the latter giving an average increase of 86.6 bu. over the nothing plot of that row, the former an increase of 77 bu. This shows that potash was the element largely needed in the soil. The yield of 1892 shows that the phosphoric acid in plots in XVIII and XIX has become largely exhausted, as the gain of the potash and bone plots had increased over the previous year, and the gain of the potash plots had largely decreased.

Plot IX, to which was applied one bushel of wood ashes, produced less than the nothing plot in 1891 and a gain of 25.7 bu. in 1892, which may seem at a variance to plots XV and XVI, for ashes contain potash and phosphoric acid, the two substances that seem essential on our soil; but ashes have a tendency to *harden* and *compact* the soil, which on our clay loam counteracted the beneficial action that it might otherwise have effected.

The conclusions are summarized as follows:

1. Considering the cost, manure is more profitable than commercial fertilizers.

2. Coarse manure is best used as a mulch.

3. Ground bone and potash furnish all the elements needed on the average farming land.

4. Nitrate of soda or sulphate of ammonia is added to the above at a loss.

5. Sulphate of potash will give as large an increase as muriate, and as its cost is one third less, it is to be preferred as a fertilizer.

6. Fertilizers unless especially prepared for potatoes, are applied at a loss, as they contain too much nitrogen.

7. Fertilizers prepared for potatoes should consist largely of potash and phosphoric acid, with from three to four times as much of the former as the latter.

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[1] The report of the R. I. experiment station for 1890, p. 25, shows a reduction in yield from 144.66 bu. to 55 bu. per acre by the addition of sulphate of ammonia to ground bone and muriate of potash.

N. J. bulletin No. 80 shows that the addition of nitrate of soda to bone-black and muriate of potash increased the yield 2.6 bu. per acre in one case, and reduced it 1.7 bu. in another, and 6.1 bu. in the third case.

POTATO SCAB.

This is the name applied to a diseased condition of the tubers in which the skin has a distended appearance similar to a scab, or where the skin and a part of the tuber is destroyed leaving a cavity in the tuber.

Wire-worms, grubs, mites, etc., have been found eating the decaying matter in the cavities, or it may be possible they add to the injury, but it is not true that they are the cause of the disease.

The disease is caused by a parasite.[1] There may be more than one form of the disease; one forming the deep scab or the cavities, and the other the surface scab, although this point is not settled at present. Prof. Bolley, from his experiments of 1891, made the following summary:[1]

"1. Scabby or disease-bearing seed tubers can and will under ordinary circumstances produce a diseased crop.

"2. Seed tubers free from the disease germs will in any soil--sand, clay, or muck—raise an undiseased product, provided only that the soils themselves are free from the disease.

"3. The seed germs can remain from crop to crop in the ground.

"4. By soaking the seed tubers before planting in certain chemical solutions I have been enabled to raise an undiseased product, whenever the ground was known to be free from disease."

From these conclusions, it is seen that, if the germs of this disease on the seed potatoes are destroyed and the potatoes are planted on soil free from the germs, the resulting crop will be free from the scab. Soils that contain the germs are those on which diseased potatoes have been raised, but the length of time that the germs will remain dormant in the soil is not known, so it is impossible yet to tell how long before the soil once affected is again free from the disease. The disease is carried by manure containing potato tops of affected tubers, or litter from around potato pits, and by tools in cultivating growing potatoes where one end of the rows is free from the disease and the other end affected.

The best method of destroying the germs of the disease is by soaking the seed in *corrosive sublimate* (bichloride of mercury). Purchase two ounces of this substance at a drug store, pour it into a vessel containing two gallons of hot water and stir frequently until it is dissolved; to this add thirteen gallons of water. After freeing the seed potatoes that are to to be treated, from the surplus dirt, plunge them into this solution and leave for one and one half hours.

If a person is to treat the seed very extensively, gasoline barrels sawed in two will make convenient receptacles. The seed can be immersed by setting wicker baskets containing the tubers in the solution; by using three of these receptacles a person can soak the seed as fast as the cutting is done. It is immaterial whether the seed is soaked before or after cutting. All seed soaked should be planted or destroyed. The solution should not be placed in metallic vessels.

Prof. Bolley's * experiments of 1892 have more than confirmed the value of this treatment. Treated seed gave a crop, of which 99.33 per cent. were free from the scab, while of the product from the untreated seed less than one per cent. were free from the scab. He says, "that not only are the tubers affected, but the base of the vine as well, which results in a short-lived vine; a greater number of tubers set upon the vines than there would be under normal conditions, and the tubers will be much smaller." Potato growers should try this simple remedy. The yield will be increased and the product secured will be much more salable.

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[1] North Dakota bulletin No. 4, from which the material of this subject is largely gleaned.

* Science, Dec. 23, 1892, p. 355.

POTATO BLIGHT.

This is the name commonly applied to the disease that causes the potato rot (Phytophthora infestans), for which the Bordeaux mixture sprayed upon the vines during the growing season is a remedy.

Another disease that has affected the potato vines at the college, during the past two seasons, resembles the true potato blight somewhat, but the Bordeaux mixture does not check it.

Persons, unacquainted with this new potato disease, seeing the vines dying, would think that his potatoes were struck with the blight, and knowing that the Bordeaux mixture prevents the blight, would apply it, probably without effect.

This new disease may attack the vines earlier in the season than the true blight. It may appear in June or not until July or August. The true potato blight does not make its appearance, generally, until after the middle of July, and the latter is much quicker in its action, the vines dying down in a very few days, while the former requires about ten days to complete its action. The leaves die first at the tips, working slowly back until the whole leaf finally becomes involved, the leaf withering and curling up as the disease progresses.

The most noticeable difference between the two diseases is that with the true potato blight the under side of the affected leaf is covered with a grayish mold, which is apparent to the naked eye; with the other disease, no such mold is found.

This department will be glad to receive specimens of diseased vines next season, from persons in doubt as to the nature of the diseases that may affect their potatoes, and will gladly inform inquirers as far as our knowledge will permit, as to the causes and remedies.

L. R. TAFT.
H. P. GLADDEN.
R. J. CORYELL.

AGRICULTURAL COLLEGE, MICH.,
February 1, 1893.

SPURRY (*Spergula arvensis*), AT GRAYLING SUB-STATION.

No. 91.—By the Director.

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It has now been about five years since we began experimenting with spurry at our Grayling sub-station, Crawford county, Mich. Its value is so apparent to all who have observed the work there, even superficially, that there seems good reason for making public the results, and recommending the use of the plant to all who are seeking a crop that will be a fertilizer for light sandy soil, and at the same time be of real value for forage.

Spurry is a new plant in Michigan, and probably in most of the states, but it is an old plant in some sections of the world. How old I have not had time to trace, but in Loudon's "Encyclopedia of Plants," first published in 1829, spurry is mentioned as follows:

> *Spergula arvensis.* From *spargere*, to scatter, because it scatters its seed abroad, to the great profit of the farmer in Holland, who obtains from it meadows affording the most delicious butter. *S. arvensis* is a common weed in sandy soils, in Scotland called yarr, and in Norfolk, pickpurse. In the Netherlands and in Germany it is sown on stubble to provide a bite for sheep during winter. It may be sown and reaped in eight weeks, either in autumn or spring. It is said to enrich the milk of cows, so as to make it afford excellent butter; and the mutton fed on it is preferable to that fed on turnips. Hens eat spurry greedily, and it is supposed to make them lay a great number of eggs, whether in hay, or cut green or pasture. Von Thaer observes it is the most nourishing, in proportion to its bulk, of all forage, and gives the best flavor to milk and butter.

Dr. Manly Miles, of Lansing, formerly professor of agriculture at the Michigan Agricultural College, visited several countries of Europe in 1874 to study the agriculture. He saw fields of spurry, and learned its value from those familiar with it. He gave an address at the farmers' institute at Grayling, in January, 1887, in which he said:

> Spurry is an annual which grows wild in Great Britain, where it is usually called a weed. In Belgium, France, Jutland and Russia it is grown as a forage crop and for hay. In France its yield is estimated to be about equal to a crop of clover, or 7,700 pounds per acre. The seeds are fed to cattle and horses, and are thought to be about equal to rape cake in value. It is a quick and rapid growing crop, which in five or six weeks gains its full height of twelve to fourteen inches, and it is said to be a valuable feed for cows, improving the quantity and quality of the butter. Sown in the middle of April with seed at the rate of fifteen to twenty-four pounds to the acre, it matures the last of May, and a second crop may be grown. * * * It has been called the clover of sandy soils. (*Report Michigan Board of Agriculture, 1887, p. 329.*)

Swartz, a well known and influential writer on agriculture in Germany, in his account of the Belgian husbandry, says:

> Without spurry, the Campine, the best cultivated soil in the world, would have been still a desert. A plant like this, which requires no manure of itself, and which, even when mown, by the residue it leaves, gives back more than it takes from the soil; which demands no fixed place in the rotation, but which is satisfied to come in as an after crop whenever the soil is at liberty; which, except for the seed, requires no preparation; which is satisfied with a soil on which nothing else but rye will grow; which increases the quantity of milk and butter, and improves their quality, and which I am persuaded may be raised with advantage, even on the best soils, provided only they are somewhat light, is of the greatest value. A proof of this is the land of Waas (Waesland in Flanders), the garden of Europe.

Von Voght, another acknowledged authority, is quite as enthusiastic in regard to the value of spurry on light, sandy soils. He says of it:

> It is better than red or white clover; the cows give more and better milk when fed on it, and it improves the land in an extraordinary degree. When sown in the middle of April it is ripe for pasture by the end of May. If eaten off in June, the land turned flat, and another crop sown, it will afford pasture in August and September. This operation is equivalent to a dressing of ten loads of manure per acre. The blessing of spurry, the clover of sandy lands, is incredible when rightly employed.

In the Report of the Department of Agriculture, Washington, 1864, on page 299, is an article by John F. Wolfinger, on "Green Manuring and Manures." Of spurry he says:

> Spurry is an annual plant extensively cultivated in Germany and in France as a winter pasture for cattle, sheep and hogs, and milch cows and sheep fed on it yield, according to Von Thaer, of Germany, superior milk, butter and mutton. For winter pasturage it is usually sown broadcast on the harrowed stubble of grain crops just removed from the ground, but it may be and often is, sown in the spring for spring and summer pasture. It is most admirably adapted to sandy soils, so much so that it has been called the "clover of sandy lands." It will grow well on sandy soils that are too poor dry and thin to bear clover, and will also if sown in March, and then again in May, and afterwards in July, produce three crops upon the same field in one season. These three crops will, if successively plowed down to the depth of three or four inches, renovate or strengthen a poor or barren soil to such a degree that it will now bring clover or a crop of winter grain. Hence spurry is largely grown in Belgium, Germany and Denmark as a fertilizer, and also as a valuable forage for cattle, both in its green and in its dried state.

When, in the spring of 1888, Dr. R. C. Kedzie consented to take charge of a part of the experiment work at Grayling, he imported, through a seed house in New York, some spurry seed from Germany, and had it sowed on the light sand at Grayling on the 17th of May of that year. The season was a most unusual one throughout Michigan. The temperature at the surface of the soil as shown by an uncovered thermometer is known to be eight to ten degrees lower than the temperature at an elevation of four feet indicated by a covered thermometer. Taking the record of a self-registering covered thermometer at the college, at the elevation of four feet, and calculating from it the temperature at the surface, it is shown that there was frost several times during every month of that summer, except July. At Grayling, which is 130 miles further north, the frosts would be still more frequent and severe. To cold was added drouth, which was probably more severe at Grayling than in the southern part of the State. In spite of the cold and the drouth the action of spurry this first season was encouraging. Is was placed next to winter vetch as a promising plant for the plains.

The next year gave better climatic conditions. The report says:

> The spurry has shown wonderful poductiveness and seed production. When partially ripened and plowed under with a very shallow furrow it is self seeding, and produces an abundant crop. Its value as a manurial plant on these light sands is pronounced. When plowed under it seems to enrich the soil the most rapidly of all plants used. It is valuable for a fodder plant, being eaten readily by cows and sheep. It is said to be very valuable for cows giving milk. It is a plant of first value in bringing these sands into productive fields. (*Report Michigan State Board of Agriculture, 1889, page 81.*)

In 1890 the good opinion of spurry continued and increased. The report says:

> Spurry still holds its high rank, and this crop is rapidly spreading in this region. With many farmers it yields a great amount of forage and they find it is a profitable crop to feed stock.
>
> The wonderful seed production gives it a good foothold in soils when once sown. The introduction of this plant is a permanent benefit to the jack pine barrens.

The work at the Grayling station has now been for two years in charge of Dr. O. Palmer, who has become a strong advocate of spurry for light lands. The use of it has spread to a considerable extent among the farmers in that section, whose experience and opinions will be quoted further on. Dr. Palmer writes me that every seed has seemed to germinate, and the fields have presented a perfectly even growth of this vine like plant, so thick and thoroughly entwined, that in walking through it the foot has to be lifted entirely over it, or sufficient force used to break the way for each succeeding step. Its average growth has been from 12 to 15 inches in height on the natural soil, but reaching two feet or more on some of the surrounding farms which have been enriched to a greater or less extent, and cutting from one to two tons of forage per acre. When ripe there is at the end of each stalk a round seed vessel, about the size of a No. 6 shot, each vessel containing from one to six seeds. The yield has been from eight to twelve bushels of seed per acre.

The soil for spurry requires the same preparation as for clover. The seed may be sown and harrowed in the same as clover seed. The seed is smaller than clover seed, hence there are more in number to the pound. When sown for fertilizer and forage, from six to eight quarts should be sown per acre. This thick seeding gives an even field of fine pasture and a heavy sward when cut for hay. When desired for hay it should be cut after the seed has formed, but before it is ripe.

When grown for seed it branches more and gives a larger crop of better seed if only about four quarts of seed are sown per acre. When grown for seed it may be threshed the same as clover, by machine or flail. When it ripens late in the fall and is then harvested for seed, enough seed will shell out to produce a full crop next spring if the land is harrowed.

The seed germinates quickly. If the weather is warm and moist the field will begin to show green on the third day from sowing. It is ready for mowing for hay in about six weeks, and will ripen the seed in about eight weeks. It is in best condition for pasture from four to six weeks after sowing, though if necessary animals can be turned on much sooner. It furnishes excellent pasturage for cattle, especially milch cows, though they often refuse to taste it at first, but after once eating it will leave the richest clover pasture to return to it. Sheep seem to prefer it above all forage, and all stock thrive upon it, when cut and cured, even eating every particle of the dry straw that has been threshed for seed.

The introduction of spurry as a forage crop alone, will prove of immense benefit, but its use as a manurial crop is of much greater value. Its effect on the physical condition of the soil is very marked. The soil at Grayling in its natural state is so open and porous, that in passing over a plowed field, one sinks into it as into a heap of dry ashes, but after the plowing under of a single crop of spurry the land becomes so much more compact that the difference will be noticed by the least careful observer. Its effects on the succeeding crops are marked in comparison with the same crop succeeding any other manurial plant used. This may be in part due to the changed condition of the soil giving a more compact seed bed, enabling the new plant better to resist drouth. The spurry itself seems especially adapted to dry soils, doing even better on such soils than where there is an excess of moisture.

There is a tendency for all grasses to grow in bunches on this plains soil. This is true of all those mentioned below, as proven by many trials. But the condition of the soil is so changed after a crop of spurry has been plowed under, that this difficulty is much lessened, and there are now plats of the following grasses very even in growth and forming a uniform sward, viz., timothy and clover, timothy and red top, tall meadow oat grass, red fescue, meadow fescue, sheep's fescue, and alsike clover.

There has not been sufficient time nor extended experiment enough to state definitely the relative increased production following spurry over that of other manures, but I am satisfied that it is far superior, on these lands, to any other manurial plant that has been used. In an experiment on an adjoining farm, more wheat was produced following spurry than where Homestead Phosphate to the amount of 300 lbs. was used per acre.

There are on the experimental farm 10 acres that were broken last spring and sown with spurry, which was plowed under in August, and the land sown with wheat. On the farm opposite is a plat of wheat following clover, and one following timothy, which had been fairly well covered with barnyard manure. The wheat on the spurry field went into winter looking stronger than either of the other fields. The result next summer will be watched with great interest.

It is believed the results already obtained by the introduction of this plant will much more than repay all the outlay that has been made at the Grayling station. The many other valuable results remain in favor of the continued work. The work of the station has just begun. Its future may develop more financial good to the State, than, pehaps, any work now in progress.

The farmers in the neighborhood of Grayling have carefully observed the action of spurry from the first. To some of them seed was given to try on their own farms, and in every case where they experimented with care they have had good success, and are now warm friends of the new plant. From some of them have come letters stating their experience with the plant and their opinion of its value. Several of these letters are here given.

Grayling, Mich., January 14, 1893.

Pres. O. Clute, *Director Experiment Station, Agricultural College, Mich.:*

Dear Sir—I have given the growing of spurry two fair trials. The first one was for fertilizing my land. I mowed four swaths 34 rods long, after it had been ripe about six or eight days, and got seven bushels of seed. I tried the dry straw for stock the next winter. Cows ate it well. Horses did not like it.

My second trial was for pasture and experiment. I like it for pasture and I like it for plowing under. It helps the land as well or better than clover. With proper care 15 or 20 bushels of seed can be raised to the acre.

Truly yours,
A. J. Rose.

Grayling, Mich., 1st, Feb., 1893.

Pres. O. Clute, *Director of the Experiment Station:*

Dear Sir—As a fertilizer spurry is next to clover. It will grow where clover will not. I sowed some on a piece of ground where the clover would not catch. In the fall I plowed it under and sowed the land with clover and timothy and got a good catch. Also last spring I sowed two acres of an eighteen acre field to spurry. In the fall I plowed the whole field and sowed it to wheat. I could tell to the very drill mark where the spurry was. The wheat was larger and thicker on the ground.

As for pasture there is nothing like it. Cattle and sheep will eat it as soon as they will clover. I sowed a small piece last summer for sheep pasture, and when it got up five or six inches high I turned the sheep into it. They ate it as close to the ground as they could. Last June I sowed five acres with turnips and spurry, and the spurry smothered the turnips out and I got a fair crop of it. In August I cut about four acres for seed. The second or self sown crop came on and was as large as the first. This winter I threshed out what I had, and there were thirty bushels of good seed from the four acres. The sheep ate the straw as well as they did the best hay.

Truly yours,
W. F. Brink.

Grayling, Jan. 30, 1893.

Pres. O. Clute, *Director of Experiment Station, Agricultural College, Mich.:*

Dear Sir—I will give you my experience and opinion in regard to growing spurry. Opinions certainly have more weight when based upon experience. The land that I sowed to spurry last year was so-called "pine barrens," or plains, rather better than the average. On it I had raised crops as follows: wheat, millet, oats, part potatoes and part peas, part corn and part millet—making in all five crops, leaving the soil in an impoverished condition. I plowed just five acres, dragged it with a flat drag, then sowed six pounds of seed per acre. I dragged once and then raked both ways with a horse rake, finishing June 15 at noon. I was suprised to find the young plants all up on the 18th of June at noon. August 18 the crop was ready to harvest. It stood about one foot high. I have made no estimate as to the amount per acre. One-half ton per acre would have been a good crop for that soil. There was certainly more than that. I did not see the field again until four weeks after cutting, when one day I was surprised at the green appearance of the stubble. Upon examination I found a volunteer crop which continued to grow until there was about two-thirds as much as at first. Wishing to use the fall pasture in other parts of the enclosure I turned my cows in. For about three days they would not notice the spurry. But after they "got a taste" they would eat nothing else so long as the spurry lasted. There was a decided increase in the quantity of milk. Also the quality was improved.

When allowed to ripen for seed I thresh it with a flail. I feed the straw to my cows together with a ration of turnips. The result is highly satisfactory, the cattle never doing better. The only trouble was in not having enough, as when the spurry was gone they refused to eat other fodder until starved to it. The crop as a whole was worth more than double any previous crop. I know that it will grow where other crops fail, also that it is the best of fodder crops for cattle and sheep. As far as I know horses do not like it.

As a manurial crop I think it will be excellent, but will test it thoroughly both by plowing under, and also by leaving on the ground as a top dressing, and protection for young clover, which I shall sow and drag in after the first harvesting.

It is my opinion, gained by experience and observation, that spurry if rightly handled will be of great value in reclaiming the pine barrens. Any plant that will grow here that will make fodder for cattle and sheep will be welcome, as sheep raising will sooner or later be the leading industry here.

Yours very truly,
Perry Ostrander,
Pres. of the Crawford County Farmers' Association.

Dr. Palmer thinks that spurry will prove a valuable crop for plowing under as a fertilizer for orchards, but of this we have not yet had experience. On the plains it has not proven troublesome as a weed, but it may be well to be cautious on this point when the crop is grown on richer soil. Experience will soon prove whether there is anything to fear.

O. CLUTE, *Director.*

February, 1893.

FLAT PEA.

(Lathyrus silvestris).

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Can the light sandy soils of northern Michigan be converted into fertile farms, where at present prices of land and labor and farm products men can win a livelihood and make comfortable homes? This is "the problem of the plains." In solving this problem we have several known quantities; the question of how many quantities at present unknown remains to be seen. Among the known quantities are:

1. A soil of light sand, usually of several feet in depth, often of many feet in depth, having very little if any vegetable mold.

2. Long, cold winters, in which the thermometer sometimes sinks as low as 30 degrees below zero. But usually vegetation is protected by a garment of snow.

3. A possibility, not to say probability, of untimely frosts. Frosts linger late in the lap of spring, they come with swift feet in the fall as to their home; sometimes visits are made at intervening times.

4. An uneven distribution of rainfall. Enough rain falls in the course of the year, but sometimes for several weeks in mid-summer there is no rainfall, or but little. The hot sun beats on the hot sand and scorches vegetation unless it has unusual powers of endurance.

A deep, sandy soil, zero winters, frosts late and early, a summer sometimes hot and dry,—such conditions are severe. As mentioned in the preceding part of this bulletin we find spurry a great help. Its quick germination, its maturity in six to eight weeks, its excellent forage for cattle and sheep, its superior fertilizing properties will continue to make it invaluable. But spurry, if one expects a full crop, must be sown for each crop, as the plant dies after seeding, and the volunteer crop, while often large, cannot be depended upon; it is more tender to the touch of cold than is desirable, sometimes being killed by untimely frosts; it does not root deeply in the soil and hence may be injured by drouths.

Can we find a plant that is perennial, that will not be cut down by pretty severe frosts, that roots so deeply as not to be greatly injured by severe drouths, that yields superior forage for all all farm stock, and that has valuable qualities as a fertilizer?

If this question can be answered in the affirmative we shall have solved "the problem of the plains," for then we can convert them into farms for breeding cattle and sheep; for producing meat, butter, cheese and wool: and be able at the same time, from the manure produced by the stock and from the fertilizing qualities of the plant, to improve from year to year the quality of the soil.

In thinking over this problem it seemed wisest to look among the legumes for this possible, if improbable, plant. Among the legumes we find the clovers, the cow-pea, the vetches, and beans and peas, all of which are of great service for forage and fertilizing, some of which are among the most important crops in the world. There are many other legumes found in nearly all climates. If the plant we are seeking can be found at all it will most probably be found among the legumes.

Having reached this conclusion I began to ask questions of those familiar with leguminous plants, and to look for hints among books and periodicals as far as other most pressing duties would occasionally permit.

While engaged in this search there came to my desk early in January, 1891, a circular making such glowing claims for a new plant, the flat pea, (*Lathyrus silvestris*), that I was at first inclined to pass it by. But after all it seemed worth while to experiment with the plant, for if the results reached were only negative they would serve to warn others against loss of time and labor and money. I sent to London, England, for five pounds of the seed, and wrote to several parties in Germany asking about the plant. I learned that the flat pea is a perennial which has long been known to botanists, that in its wild state it contains some elements that make it unpalatable and unhealthful to animals, but that Herr Wagner, of Wurtemburg, has been experimenting with it for many years, and that it is claimed that he has bred out the undesirable qualities, leaving a plant most valuable for forage and fertilizer, and adapted to different soils and climatic conditions.

The seed came to hand early in March, 1891, plump, clean, apparently in good condition. I sent a small quantity to our sub-station at Grayling, where it was planted all right in May, 1891. But when it was planted the weather was dry, and after planting there was no rain until late in summer. The seed did not germinate at all. In this failure to grow it was not alone, for seeds of other plants in adjacent plots did not germinate, or else came only to a feeble growth after the fall rains began. In the spring of 1892 I sent more seed to Grayling, which germinated at the right time. The plants made a top growth of six to eight inches and a root growth of twelve to fourteen inches, the roots running well down into the soil and being supplied with many tubercles, such as have attracted such wide attention within a few years as the agents in secreting nitrogen from the air. In 1892 I sent to Grayling a few dozens of plants of the flat pea from among those grown at the college, which were set out and made a promising growth of tops and roots, the roots showing the marked tendency to run deep and to be well supplied with tubercles.

Desiring to have personal supervision of the care of the plant and to watch its action, and also to get a quantity of the plants to producing seed as soon as possible, I determined in the spring of 1891 to sow much the larger part of the seed on a sandy knoll at the college. This knoll had been under cultivation for a number of years, and had been fertilized from time to time, hence the growth of the flat pea here cannot be taken as indicative of what it will do on even lighter and entirely unfertilized soils, but this plot was in about the same condition and had about the same history as much of the sandy soil in large areas of southern Michigan. The seed was sown about 3 in. deep in drills 2½ ft. apart, May 8, and a few days later. The seed has a very hard outer coat, and germinates slowly. The seed was sown in a dry time, and only a little rain fell for some weeks. The soil was full of the seeds of weeds which started in great profusion, and by the time the flat pea was up at the end of twenty-three days, the weeds were so well grown that it was vain to try to exterminate them and save the plants of the pea. The whole plot had to be plowed up.

In order to insure against the destruction of all the plants by a possible drouth, I had selected in the beginning a low place in the garden, sufficiently near the forcing house to carry water in a hose for watering, in case of need. The soil was deep muck, and had been well cultivated for some years. It was chosen not for the purpose of showing the capacity of the flat pea to grow on poor soil, but for the purpose of trying to insure the growth of some plants from a portion of the costly seed.

Here the seed was planted fully three inches deep, about two inches apart in the drills, and the drills fifteen inches apart. It came up in three weeks, every seed seeming to germinate. Rain came, so that it was not necessary to water. The plants made a vigorous growth, and by fall were twelve to fifteen inches high. They were healthy, strong, luxuriant. The roots grew deep and wide, extending twenty-four inches down and fifteen to twenty inches on each side. They were abundantly supplied with nitrogen-secreting tubercles, or rather with tubercles to serve as homes for the nitrogen-secreting bacteria. In the cool weather of the fall the plants throve well. The first frost of the season came the night of October 7. The plants showed no evil effects. Frosts followed on October 8 and 9, but still the plants were green and vigorous. Other frosts on subsequent nights and days affected the plants slowly, some of the leaves turning yellow and the whole plant becoming somewhat brown, but when college closed in the middle of November the plants were still growing. The really cold weather had been slow in coming.

The plants wintered well. All started growing as soon as frost was out in the spring. April 2d, the rows were green. The plants had been grown in the rows close together. I desired to give them more room and to get them upon sandy soil, hence upon April 19 they were all transplanted, except three rows which were left in the muck. They were put upon the land where the year before the weeds had smothered the plants. In digging we found all the roots strong and fleshy, and the smaller ones with many tubercles. In transplanting, the roots were cut to about six inches in length. They were planted in rows fifteen inches apart, and four inches apart in the row. They grew well throughout the spring and summer. The rows were cultivated sufficiently to keep the weeds down, which was an easy task, as the pea vines soon covered the ground.

In August and September one-tenth of an acre yielded 1,046 lbs. of green forage, or 10,460 lb. per acre. It is probable that the yield would have been larger had the plants grown on the soil, so as not to need transplanting, as this checked the growth. The green forage was fed to cattle quite liberally and seemed to be greatly relished.

The flat pea had given such indication in its first year (1891) with me that last spring (1892) I procured ten pounds more of the seed, which was sown on the sandy knoll where I first began, and adjacent to the plat to which the plants grown on muck the previous year had been transplanted. The seed was again put in rows 2½ feet apart.

Taught by the experience of the previous year I directed turnip seed to be sown over the flat peas. That is, the peas were sown with a drill about two inches deep. Another drill followed, and sowed turnip seed about an inch deep in the same row. The turnip seed germinated very soon, and marked the rows so that they could be cultivated, and so keep the weeds down. The turnips were pulled out as soon as no longer needed. The flat peas germinated well. The earliest plants appeared at the surface in 17 days and others followed rapidly, so that a few days later all were up. There had been plenty of rain, and the weather was fairly warm. In a dry, cool season, the plants would be longer in getting to the surface.

The plants were kept free from weeds, the horse cultivator and the hand hoe being used. The cultivation must be carefully attended to. If in one year a grower were starting a large area of plants the cultivation would become a somewhat serious problem. The plants made a very satisfactory growth, reaching before cold weather a height of 12 to 15 inches, and having roots 18 to 24 inches long, with plenty of tubercles. Again, as frosts came on they kept a green and thriving look until the ground froze, about Dec. 1.

The plants of the year 1891, left in the spring of 1892 to grow on the muck, did not do very well. The early part of the season was quite wet, and water often stood around the plants, and probably they had wet feet all the time. Still they lived and grew. All will be removed next spring.

Our experience with the flat pea for two years is:

1. It germinates and reaches the surface in from 17 to 28 days.
2. It grows slowly at first after reaching the surface, and needs care to keep weeds down.
3. It makes, on very poor, unimproved sandy soil, a top growth of six to eight inches and a root growth of 12 to 15 inches, the first year.
4. It makes on sandy soil that has been cultivated and improved, a top growth of 12 to 15 inches, and a root growth of 18 to 24 inches, the first year,
5. The tops are not easily cut down by frost. The roots go through the winter well.
6. The roots are thickly supplied with tubercles.
7. One year old plants transplanted in the spring to sandy soil, gave at the rate of 10,460 pounds of green forage per acre.
8. It does not bloom the first year. With us the blooms, pods, and seeds have been few the second year.
9. Cattle eat the green forage readily.

During the coming season the experiment will be continued. The action of the plants on the sandy soil at Grayling will be carefully watched, as will that of the two-year-old plants, and the large plat of one-year-old plants at the college.

Reports that this station has this plant in cultivation crept into the papers, and letters have been coming asking about it, therefore it seemed best to make this report of progress at this time.

We have none of the peas and none of the plants for sale or to give away.

O. CLUTE,
Director of Experiment Station.

February 15, 1893.

FRUIT NOTES.

No. 92.—Horticultural Department.

This station, with a sub-station in the Lake Shore fruit belt at South Haven, has excellent facilities for testing new varieties of fruit. The results of the past season's work at South Haven will be found in Bulletin No. 88, published in December, 1892.

This bulletin contains the notes on some of the small fruits grown in the college gardens the past year.

STRAWBERRIES.

The strawberries tested number about one hundred and seventy-five varieties. In the spring of 1892 eighty additional new sorts were set out. A large proportion of these were sent here by the originators for trial before placing upon the market. Many are unnamed seedlings. When obtainable the number of plants tested is twenty-four.

The following table includes the more promising of the varieties grown. None of the sorts planted last spring are given:

Table No. 1.—*Strawberries.*

ABBREVIATIONS.

Form.		Size.	Color.	
b. broad.	l. long.	s. small.	b. bright.	l. light.
c. conical.	o. ovate.	m. medium.	c. crimson.	r. red.
d. depressed.	r. round.	l. large.	d. dark.	s. scarlet.
i. irregular.				

Variety.	Sex.	Vigor (1—10).	Date of bloom.	First ripe fruits	Last fruits.	Productiveness (1—10).	Size.	Form.	Color.	Quality.	Firmness.
Alpha	b	7.3	May 24	June 13	July 6	9	m	c	l c	8	6
Amateur	b	7.5	" 28	" 20	" 12	7	m	b	l s	7	8
Arlington	p	9	" 27	" 20	" 12	9	m	r c	s	8	8
Auburn	p	9.8	" 30	" 20	" 6	8	m	o c	l c	9	8
Augur No. 70	b	8	" 29	" 20	" 12	7	m	c	c	10	9
Banquet	p	7.5	" 25	" 14	" 1	6	m	c	d c	10	6
Barton's Eclipse	p	10	" 25	" 13	" 6	10	s to m	o	l c	8	8
Beder Wood	b	9.9	" 21	" 20	" 6	10	s to m	r	l c	7	8
Belle	b	9	" 22	" 23	" 8	9	m to l	l c	b s	8	9
Belmont	b	8.5	" 30	" 20	" 1	6	m	l o	b c	9	10
Boynton	p	10	" 20	" 16	" 6	9	s	o	l c	8	8
Bubach No. 5	p	9.8	" 25	" 16	" 6	8.5	l	d c	l c	9	8
Burt	b	7.8	" 28	" 14	" 6	6	m	r d c	l s	7	9
Charleston	p	2	" 30	" 20	" 1	4	m	r c	b r	8	8
Cling To	b	10	" 25	" 22	" 7	6	m	o c	l c	8	9
Clinton	b	9.5	" 25	" 23	" 6	9	m	b c	d s	8	8

TABLE No. 1.—CONTINUED.

Variety.	Sex.	Vigor (1—10).	Date of bloom.	First ripe fruits.	Last fruits.	Productiveness (1—10).	Size.	Form.	Color.	Quality.	Firmness.
Cloud	p	9.5	May 27	June 23	July 6	9	m	r c	d r	8.5	9
Crawford	b	9	" 25	" 23	" 6	8	m	r c	s	9	9
Crescent×Glendale	p	9	" 30	" 23	" 6	8	m	r c	c	7	9
Crescent	p	9	" 17	" 13	" 6	9	m	r c	b	7	8
Cumberland	b	5	" 29	" 23	" 12	6	m	r c	l c	8.5	7
D. & D.	b	9	" 20	" 20	" 1	7	m	r c	d c	8	8
Daisy	b	8.8	" 29	" 20	" 6	9	m	r c	l s	8	7
Dew	b	7	" 2	" 20	" 6	8	l	i	d c	8	9
Dubois	b	7	" 25	" 23	" 1	4	m l	r	d r	8	8
Edgar Queen	b	8.5	" 28	" 20	" 6	9	m l	i r c	l c	6	8
Eureka	p	9.4	" 28	" 23	" 6	9	m	r c	d c	7	8
Felton	b	9.5	" 25	" 20	" 6	7	m	r c	b c	8	9
Florence	b	4	" 31	" 23	" 6	8	m	r c	b c	7	8.5
Gandy	p	9.8	" 28	" 20	" 12	9	m-l	r b c	l c	9	8
Gen. Putnam	b	9.9	" 21	" 20	" 12	10	m-l	r	l s	8	8
Gillespie	b	9.8	" 25	" 20	" 1	7	m	o c	l c	8	7
Great Pacific	p	10	" 25	" 20	" 6	9.5	s to m	d c	r	9	6
Hart's Minn.	b	8.5	" 25	" 23	" 6	8	m-l	r b c	s	8	8
Haverland	p	8.9	" 21	" 14	" 6	9	m	l c	s	8	8
Hovey's Seedling	p	4	" 28	" 20	" 1	8	m	r c	c	9	8
Jessie	b	9	" 25	" 16	" 6	8	m-l	r c	d c	7	9
King No. 2	b	9.5	" 30	" 20	" 6	8	m	r c	l c	8	8
Lady Rusk	p	7	" 24	" 16	" 1	7	m	r c	d c	7	8
Lida	p	9	" 24	" 20	" 6	8	s to m	r c	b c	7	8
Little No. 5	b	10	" 25	" 20	" 6	7	l	l c	c	8	8
Little No. 6	b	9.5	" 28	" 20	" 12	9	m-l	r c	d c	7	7
Little No. 15	b	9.8	" 25	" 20	" 6	9	m	b c	c	9	8
Logan	p	7.5	June 1	" 20	" 6	9	m	r d c	b c	8	7
Loudon No. 15	b	9	May 25	" 20	" 1	8	m-l	r c	l c	8	8
Lovett's Early	b	9	" 25	" 20	" 6	9	m	r c	b c	8	8
Lower	b	9.9	" 30	" 20	" 6	9	l	r c	d s	8	8
Maggie	b	7	" 19	" 20	" 6	4	m	b c	b s	8	8.5
Martha	p	10	" 25	" 20	" 6	9	m	r d c	d r	7	7
Michels	b	10	" 17	" 13	" 28	5	s	c	b s	7	7
Miner	b	8.5	" 25	" 20	" 6	9	m to l	c	d s	8	7
Moore's Early	b	9.6	" 24	" 20	" 6	8	m to l	b c	b s	8	8
Mrs. Cleveland	p	10	" 25	" 20	" 6	10	m	r b c	b s	8	8
Muskingum	b	10	" 28	" 23	" 12	9	m to l	d c	d r	8.5	7
Oliver	b	10	" 29	" 23	" 12	6	m	r c	d c	6	9-
Ohio	p	7	" 25	" 23	" 6	8	l	c	c	8	8
Parker Earle	b	9.8	" 24	" 23	" 6	9	m	l c	b s	8	8-
Pearl	p	10	" 25	" 20	" 6	10	m	r c	c	8	9
Princess	p	8.8	" 29	" 19	" 6	8	m l	r	s	9	8
Price's Seedling	b	9.9	" 25	" 16	" 7	9	m	c	l c	9	8
Pride of Albany	b	3.5	" 30	" 23	" 6	8	m	r b c	d c	8	7
Sadie	p	10	" 21	" 14	" 12	10	m	r c	d c	7	8
Saunders 10	b	9	" 30	" 23	" 12	7	m-l	l c	b s	7	8
Sharpless	b	9.7	" 25	" 16	" 6	8	m	b c	b c	8	6
Shaw	b	9	" 25	" 20	" 1	7	m	r b d	b c	9	8
Stayman No. 1	p	9.5	" 28	" 13	" 6	10	m	r o	l s	8	6
Stimmel No. 15	p	8	" 27	" 23	" 6	8	m	b c	l s	9	8
Stimmel No. 20	p	8	" 30	" 23	" 6	6	s m	l c	d c	9	8
Tippecanoe	b	5	" 30	" 22	" 1	7	m	r	b s	9	8
Townsend No. 3	p	8.7	" 21	" 23	" 6	8	s	r d	d c	7	8
Townsend No. 19	p	9	" 21	" 20	" 6	9	m	r d	b s	8	8
Van Deman	b	5	" 19	" 23	" 1	4	m	r c	l c	8	8
Viola	b	9.5	" 30	" 20	" 12	8	m	c	l c	6	8
Waldron	p	9	" 28	" 20	" 12	9	m	r c	b s	8	8
Walton	p	7.5	" 20	" 16	" 1	5	s	r	s	8	8
Warfield No. 2	p	7	" 21	" 16	" 1	5	m	r c	b c	8	7
Westbrook	p	9.5	" 25	" 14	" 1	8	m	c	d c	8	9
Woodruff No. 1	b	4	" 21	" 23	" 6	6	s m	l c	d c	6	8
Woolverton	b	5	" 28	" 23	" 6	5	m	l c	d c	8	9
Yale	b	6.5	" 28	" 23	" 6	7	m	r c	d c	8.5	9.5
Zanesfield	b	9.9	" 18	" 20	" 6	9	m	o r	l c	8	7

To test the comparative productiveness of some of the leading varieties, a row, twenty rods long, of each sort, was planted in the spring of 1891. The previous fall a row of Bubach, Haverland, and Pearl had been set out for comparison with spring-set plants. The fall-set plants make up the row first given in the table below. The plat was well manured before the plants were set out and given good cultivation afterward. When the ground was frozen the plants were covered with marsh hay. In the spring the covering was removed from the plants and allowed to remain in the rows as a mulch.

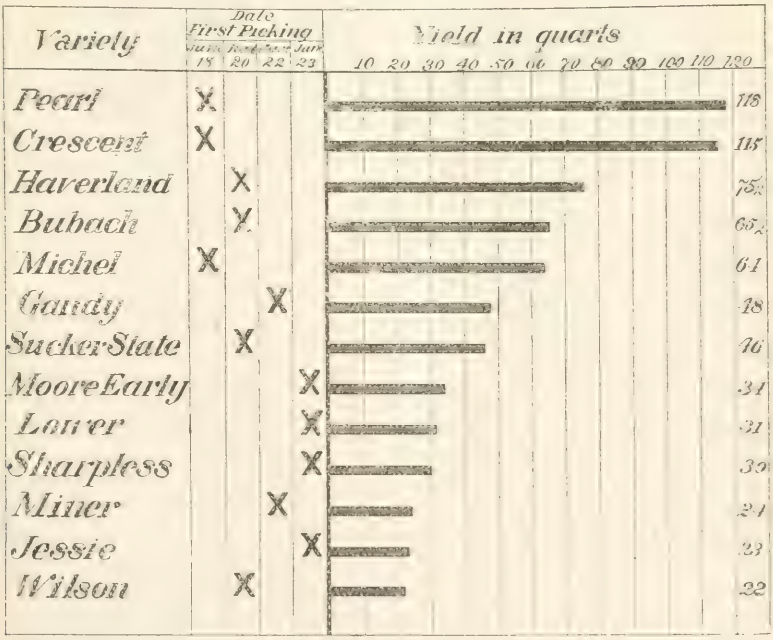
The following table gives the crop obtained:

TABLE No. 2—*Dates of picking.*

Variety.	June 18.	June 20.	June 22.	June 23.	June 24.	June 25.	June 28.	June 29.	July 1.	July 2.	July 5.	Total.
*Bubach, No. 5		4	13	20		8	15		8	2		70
Bubach, No. 5		5	22	1½	4	7	15		5	1	½	61
Crescent	12	14	8	29		22		24		6		115
Gandy			12	8		8	8		8	4		48
*Haverland		8		36		9	13		9		1	76
Haverland		8	16	16		14		12	4	4	1	75
Jessie				14		4		3		2		23
Lower				4		6		12	4	4	1	31
Michel and Osceola	28	12		6	16			2				64
Miner			4	4				14		2		24
Moore's Early				8	16			8		2		34
*Pearl		12		44		18	20		16	5	3	118
Pearl	2	20	6	34	6		24	20		6		118
Sucker State		2	7			17		16		4		46
Sharpless				8		5		15		2		30
Wilson		8			6			8				22

* Fall set plants.

The following diagram shows at a glance the earliness and productiveness of the varieties in the preceding table:



A few of the more promising of the new varieties, together with some older sorts, were chosen to note productiveness. Twenty-five plants of each sort were taken, as this number usually comprises a variety test. The berries were picked as they ripened and the date and quantity gathered noted.

TABLE No. *4.—Dates of picking.*

Varieties.	June 20.	June 22.	June 23.	June 25.	June 29.	July 1.	July 2.	July 5.	Total.
Barton Eclipse	1	------	2½	2	3	------	------	------	8½
Boynton	3¼	1	3	4	4	------	------	½	8
Cling To	------	------	¾	1	2½	------	------	------	4¼
Daisy	¼	------	1½	1½	2	------	------	½	5¾
Great Pacific	¾	1¼	1	2½	2	------	------	------	7½
Hart's Minnesota	1¼	1	½	1	3	------	------	½	7¼
King No. 2	------	------	¾	------	2	½	------	½	3¾
Lida	¾	------	1	1	2½	------	------	¼	5½
Loudon No. 15	------	------	2	½	2	½	------	½	5½
Martha	------	------	2	1¼	5	2	------	------	10¼
Mrs. Cleveland	3½	------	3½	2	3	------	------	------	12
Muskingum	¾	1	------	2	3	------	------	1	7¾
Price's Seedling	2	------	------	2	2	------	1	¾	7¾
Princess	1	------	2¼	------	2	------	------	------	5¼
Sadie	3	------	4	3½	7	½	------	½	18½
Waldron	------	½	1½	1½	1½	------	------	------	5
Welch	------	------	2	1½	½	------	½	------	4½
Woolverton	1	------	4	1	4½	------	1	1	12½
Zanesfield	------	------	1	2	1½	------	------	½	5

DESCRIPTION OF VARIETIES.

NEW. PROMISING.

Banquet was received from J. R. Hawkins, Mountainville, N. Y. The plants are not very vigorous, and but moderately productive. The fruit is of medium size, beautiful color, and regular form. Its appearance and high quality make it a very desirable home variety.

Little No. 6 and No. 15. From John Little, Granton, Ont. The plants of these varieties are of very strong and healthy growth. The fruit is large, of good color, regular form, firm, and quality good. They are worthy of trial as market varieties.

Loudon No. 15, from John Little. A variety promising well and worthy of a name.

Martha, from Matthew Crawford, Cuyahoga Falls, Ohio. Plants of strong, vigorous, and healthy growth. Fruit-stalk long, slender, and reclining. Fruit of medium size, rather small at close of season, dark crimson color, moderately firm, acid flavor. Very productive.

Princess. Plants vigorous and healthy. Fruit round, short, conical, sometimes irregular in form, bright scarlet color, and of excellent quality. Lacking in firmness. Productive.

Price's Seedling, from C. A. Green, Rochester, N. Y. Plants healthy, vigorous, and productive. Fruit long, conical, usually with a neck, bright scarlet color, excellent in quality and moderately firm. Regard it as a good berry.

Sadie, from Cleveland Nursery Co., Lakewood, Ohio. A great plant-producer. Plants vigorous and healthy. Fruit medium-size, round, conical, dark crimson color, of good quality, and moderately firm. Very productive. Valuable.

Thompson No. 23, from Cleveland Nursery Co. This variety was not in a favorable location for a thorough test. The fruit is of medium size, round, conical form, dark crimson color, and of good quality. It is a promising berry.

Westbrook. Plants received from L. J. Farmer, Pulaski, N. Y. Plants fairly vigorous, slightly attacked with fungus. Fruit medium size, conical, dark crimson color, firm. Valuable for earliness and handsome appearance.

Boynton, from Matthew Crawford. Plants quite vigorous but of slender growth. Fruit-stalk slender, reclining. Fruit medium in size, conical, regular form, crimson color, moderately firm, and of acid flavor. Productive, but the last of the crop is small in size.

The above mentioned varieties have been on trial for two or more years and have not been described in previous bulletins. They comprise the *few* among the *many* varieties on trial that are of special merit. The new varieties set out in the spring of 1892 will be given careful attention during the coming season and the results given in next year's bulletin.

VARIETIES REPORTED FAVORABLY IN 1892.

The following varieties were favorably reported upon in bulletin No. 81, published in March, 1892. The past season's trial warrants us in again placing their merits before the public. For an extended description of the varieties see Bulletin No. 81.

Arlington, Daisy, Lovett's Early, Mrs. Cleveland, and Townsend No. 19. Plants vigorous and productive. Promise well as early market sorts.

Belle, Crescent× Glendale, Florence, Muskingum, Saunders, Stimmel No. 15, and Woolverton are somewhat later than the sorts preceding, but are well worthy of trial as market varieties.

Lida, for hill culture, on rich, heavy soil, with good cultivation, is an excellent variety.

Cling To, Edgar Queen, Great Pacific, King No. 2, Stayman No. 1, Townsend No. 3, Waldron and Zanesfield possess many valuable qualities but require further trial.

VARIETIES OF DOUBTFUL VALUE.

Most of the following sorts have been on trial for several years. While each possesses some valuable qualities, there are so many *better* sorts that they have been placed in the doubtful list.

Lady Rusk, Tippecanoe, Woodruff No. 1, and Yale lack vigor of plant and fruitfulness.

The plants of the following varieties are vigorous and usually healthy, but they are not up to the standard in productiveness: *Acme, Auburn, Bubach No. 34, Clinton, Cloud, Dew, Loudon No. 34, Logan, Little No. 5, Ohio, Oliver, Shaw and Welch.*

Barton Eclipse. The plants blossomed very full and gave promise of a large crop of fruit, but soon they were badly attacked with fungus. The fruit lacks firmness and quality.

Beder Wood. The plants are vigorous and gave a large crop of fruit, but soft and of poor quality.

D. & D. Last year this variety was promising. The plants lacked in productiveness this season.

Dubois. Plants lack somewhat in vigor. Fruit large, rich, dark color, of excellent quality, but soft. Lack productiveness.

Eureka. Plants vigorous. Produced a fair crop, but fruit of light color and soft.

Gen. Putnam. Plants vigorous and fairly productive. Fruit of medium size, light color, and of poor quality.

Howard No. 6 and Prince of Berries. Plants vigorous. Fruit of good color and quality. Lack productiveness.

Van Deman. The plants the past season showed lack of vigor and fruitfulness.

VALUELESS.

The following sorts do not possess sufficient merit to warrant further trial: *Charleston, Everbearing, Gillespie, Loudon No. 29, Mammoth, Pioneer, and Porter's Seedling.*

NOTES ON MARKET VARIETIES.

The following notes on some of the better known market sorts are made up, partly from our own experience and partly from the opinions of growers in different sections of the state, and may be of value to the general planter.

Alpha. Hardy, vigorous, and fairly productive. A good early market berry.

Bubach No. 5. Plants vigorous. Fruit large, handsome appearance, but not of high quality. A good seller and profitable for near market.

Cumberland. An old berry, but still a favorite for home use and near market.

Crawford. A comparatively new sort. Fruit large, handsome, and firm. Lacks somewhat in productiveness. Needs further trial.

Crescent. Though lacking in quality, its vigor and productiveness place it at the head of the list for market.

Enhance. A good yielder, but on account of its irregular shape does not sell well. Particularly desirable on lands subject to late frosts.

Gandy. A moderate bearer. Valued for its large, handsome fruit and lateness in ripening.

Haverland. Productive. Fruit of handsome appearance and a good seller in a near market.

Jessie. Did not meet expectations and is now nearly superseded, though a good berry if given extra care.

Michel's Early. Very early. Yields about half a crop, but brings good prices because of its earliness. The crop is exhausted by two or three pickings, A good pollenizer.

Parker Earle. Rather late. Productive. A very promising market variety, destined to be largely planted. In some localities it is not so well spoken of.

Pearl. Plants hardy and vigorous. Productive. Fruit firm and of handsome appearance. Holds its size to end of the season. In some localities it is attacked with rust.

Sharpless. Still holds its place as a berry for home use and near market.

Warfield. By many regarded as the coming early market berry. It certainly promises well in most localities, but should be given farther trial before fully determining its place.

Wilson. An old sort and still largely planted. In some seasons and localities almost a failure on account of rust.

LIST FOR HOME PLANTING.

Alpha, Cumberland, Sharpless, Parker Earle, Gandy.

LIST FOR MARKET.

Crescent, Pearl, Haverland, Bubach, Parker Earle, Warfield.

RASPBERRIES.

In the following table not all the varieties grown are given. A few of the well known sorts, together with such new varieties as have fruited for two or more years, are tabulated.

TABLE No. 5.—*Raspberries—Black and Hybrids.*

ABBREVIATIONS.

Size.	Form.	Color.	
s. small.	r. round.	b. black.	g. glossy.
m. medium.	c. conical.	p. purple.	l. light.
l. large.	o. ovate.	o. orange.	pu. pubescent.

Variety.	Vigor. Scale (1-10).	Date bloom.	First ripe fruits.	Last fruits.	Productiveness. Scale (1-10).	Size.	Form.	Color.	Quality.
Ada	7	June 13	July 20	July 30	7	m	r	g b	8
Caroline	5	" 12	" 16	Aug. 1	8.5	m	r	l o	8
Conrath's Early	9	" 7	" 6	July 24	9	l	r	b	8
Cromwell	8.5	" 7	" 6	" 26	8.5	m	r	b	8
Centennial	5	" 10	" 5	" 20	9	m	r	g b	7
Gregg	8.5	" 13	" 18	Aug. 5	8	l	r	b pu	6
Hopkins	8	" 10	" 11	July 26	8.5	m	r	b pu	7
Kansas	9	" 8	" 5	" 24	9.5	l	r	g b	9
Kellogg	6	" 9	" 11	" 27	9	m	r	b pu	8
Lovett	9	" 10	" 5	" 22	8	m	r	b	9
Mammoth Cluster	8	" 11	" 18	Aug. 3	9	m	r	b pu	8
Nemaha	8.5	" 13	" 15	July 27	8.5	l	r	b pu	6
Ohio	9	" 12	" 14	Aug. 1	9	l	r	b	6
Older	9	" 11	" 11	July 28	8	l	r	b	7
Palmer	7	" 10	" 8	" 23	5	sm	r	b	8.5
Progress	8	" 11	" 11	" 23	5	m	r c	b	8.5
Surrey	7	" 13	" 10	" 24	4	m	r	b pu	7
Sweet Home	7	" 13	" 3	" 22	7	m	r	g b	7
Souhegan	7.5	" 11	" 7	" 23	9	m	r	b	8
Shaffer	9	" 16	" 16	Aug. 8	8.5	l	r o	p	9
Tyler	8	" 8	" 6	" 4	9	m	r	b	8
Virginia	9	" 7	" 6	" 25	8.5	l	r c	b	8.5

NEW VARIETIES.

Conrath's Early. Plants from Conrath Bros., Ann Arbor. Bush strong growth. Berry large, round, jet black, firm, has a sprightly acid flavor. Ripens early. Productive. A promising variety.

Kansas, from A. H. Griesa, Lawrence, Kansas. July 5 first fruits ripening. Bushes vigorous, healthy, and bearing a full crop. July 11 the crop is at its best. Berry large, glossy black, firm, and good in quality. This was the most productive black-cap grown this season. July 22 the last picking was made. Toward the close of the season many of the berries were small and imperfect. Seems to be worthy of general planting.

Lovett's Early. J. T. Lovett, Little Silver, N. J. July 6 first berries ripening. Bushes vigorous and give promise of a fair crop of fruit. The crop at its best July 11. Berries of medium size, black, of good quality; seeds small. The crop does not fulfill the promise given early in the season. The last pickings are under-size and imperfect. Moderately productive.

Cromwell. Plants from Hale Bros., South Glastonbury, Conn. July 6 the first picking was made. Bushes vigorous and fairly productive. July 12, crop at its best. Fruit round, conical, lacking in firmness, but of good quality; seeds small. July 20 the last fruit ripe. Nothing especial to recommend the variety.

Older, from J. T. Lovett. July 11, first picking. The most of the berries were ripe July 16. Bush vigorous, of low-spreading growth. Berry round, jet black, large, firm, has an acid flavor. Moderately productive.

Palmer. Plants from C. A. Green, Rochester, N. Y. The bushes made but little growth during the season and bore but few berries. Needs further trial.

Progress, from Lovett. The bushes made a good growth and are doing well. Needs further trial.

Surrey. Plants from Cleveland Nursery Co., Rio Vista, Va. First fruits ripening July 10. Bushes are small and made but slow growth during the season. July 16, most of the crop ripe. The bushes were not productive this season. Berries medium in size, resembling Gregg in form and color, firm.

Virginia. Cleveland Nursery Co. Bushes vigorous and healthy, bearing a fair crop of fruit. July 10, crop at its best. Fruit large, jet black, round, conical, moderately firm and of excellent quality. This variety holds out well to the end of the season. Promising.

SUMMARY.

For early black-caps Souhegan or Tyler are as good as any of the old sorts. Hopkins, Kellogg, and Mammoth Cluster follow soon, and are hardy and productive. Ohio is an excellent variety for the general grower. The berries are not of high quality, but the bushes usually bear a good crop of fruit. Shaffer is excellent for canning. The bush is a strong grower and very productive. The color of the fruit is somewhat against the variety, but when well known it is likely to be largely planted. Of the later kinds Gregg and Nemaha are among the best. Of the new varieties, Kansas, Conrath's Early, and Virginia are particularly promising.

TABLE No. 6.—*Raspberries, red.*

ABBREVIATIONS.

Size.	Form.	Color.	
s. small.	r. round.	d. dark.	o. orange.
m. medium.	c. conical.	r. red.	b. bright.
l. large.	o. ovate.	p. purple.	

Variety.	Vigor. Scale (1–10).	Date bloom.	First ripe fruits.	Last fruits.	Productiveness. Scale (1–10).	Size.	Form.	Color.	Quality.
Brandywine	------	June 16	July 15	July 28	7	m	r c	d r	8
Burlington	------	" 12	" 8	" 21	4	l	r c	r	9
Cuthbert	------	" 16	" 15	Aug. 6	9	l	r c	r	8
Gladstone	------	" 13	" 15	July 27	8	l	r c	d pu	9
Hansell	------	" 14	" 6	" 28	5	m	r	d r	9
Herstine	------	" 14	" 13	Aug. 2	8	m	r	b r	9.5
Henrietta	------	" 17	" 19	July 29	8	m	r	r	8
Heebner	------	" 16	" 18	Aug. 1	9	l	r c	r	9
Lost Rubies	------	" 14	" 17	" 5	6	s-m	r	d c	8
Miller's Woodland	------	" 14	" 18	" 3	9	m	r	r	8
Michigan Early	------	" 11	" 4	July 27	9	s	r	r	9
Marlboro	------	" 15	" 16	" 27	6	m	r	r	6
Philadelphia	------	" 14	" 16	" 28	8	m	r	d p r	7
Red Cluster	------	" 16	" 18	Aug. 5	7	m	r c	r	9
Reder	------	" 14	" 16	" 5	5	m	r	r	9
Scarlet Gem	------	" 13	" 14	July 29	5	m-l	r	b r	5
Turner	------	" 13	" 6	" 27	5	m-l	r c	r	9
Talcott	------	" 13	" 3	" 30	8.5	m	o	r	9

In the above list Hansell and Michigan Early are to be recommended for early varieties. Hansell has not proved to be very productive with us. As a medium-season berry Cuthbert stands at the head of the list, and is the sort to be planted for the main crop. Turner is hardy and of best quality, and is valuable for these properties.

NEW VARIETIES.

Gladstone. Plants from C. A. Green, Rochester, N. Y. Bushes strong-growing, healthy. Fruit large, dark purple color, pubescent, excellent quality, and firmer than Shaffer. Promises well.

Royal Church, from Royal Church, Harrisville, Ohio. Bushes are hardy, vigorous, and of loose, spreading growth. Fruit very large, round, conical form, dark crimson color, and of a rich, aromatic flavor. The seeds are very large and so loosely joined that the berry falls to pieces easily—a serious fault. The bushes are as productive as any of the red sorts.

DEWBERRIES.

Lucretia. First fruits ripe July 19. The fruit is large and of excellent quality. The bushes are moderately productive. The vine requires training to a trellis to make the culture practicable. Dewberries are little grown and if valuable at all would be so on account of earliness in ripening, quality of the fruit, and ease of protection in winter.

WINEBERRY.

Japanese Wineberry. This fruit has received considerable advertising and the plants have been sold at high prices. The bushes are of vigorous growth and handsome appearance. The fruit is borne in clusters and the berries are enclosed in a mossy calyx. They are of medium size and have a sprightly, acid flavor. The fruit falls to pieces when picked from the bush. The bushes can scarcely be called productive, and the fruit, if valuable at all, is *only* so as a *curiosity.*

The above is one of the many examples of over-advertising, and shows the value of the test stations to the general public.

H. P. GLADDEN.

CURRANTS AND GOOSEBERRIES.

CURRANTS.

The plantation of currants is placed with that of the gooseberries, as the treatment and cultivation are the same. These fruits delight in a moist, rich, cool soil. These conditions are generally supplied by manuring annually and by placing the plantation on land that slopes to the north.

The pruning consists of removing the old wood and the surplus young shoots. In general, wood that has raised three crops of fruit should be cut out, and enough sprouts should be left to take its place.

The currant worm is kept in check mainly by the use of the arsenites. A thorough spraying at the time that the first eggs hatch is frequently sufficient for a whole season. Frequent rains at this time will make subsequent sprayings desirable. If it is necessary to spray at the time that the fruit is being picked, white hellebore is safer to use, as this is not poisonous to a human being. The arsenites in the hands of an experienced and careful person would not be dangerous, but their indiscriminate use should be avoided.

The yellow-lined currant bug was present this past season, but not in sufficient numbers to be a serious pest. It is found during the month of June sucking the juice from the youngest and most tender leaves. It is easily recognized by those not acquainted with it by its color, which is bright yellow, lined with black. It takes fright very easily and hides under the leaves. In large numbers, it seriously injures the tips of the new shoots. Kerosene emulsion is recommended where they become troublesome.

The following table gives most of the data of the varieties:

Ribes aureum—Yellow flowering currant.

Name.	First bloom.	Ripened.	Vigor (1 to 10).	Productiveness (1 to 10.)	Size (1 to 10).	Quality (1 to 10).	Remarks.
Crandall	May 8	July 20	10	8	10	8	No value here.

Ribes nigrum—Black currant.

Name.	First bloom.	Ripened.	Vigor (1 to 10).	Productiveness (1 to 10.)	Size (1 to 10).	Quality (1 to 10).	Remarks.
Black Champion	May 8	July 14	9	5	10	8	Much like the Black Naples.
Black Naples	" 6	" 14	10	6	9	8	Vigorous.
Lee	" 7	" 15	8	5	10	8	Resembles the Black Naples.

Ribes rubrum—Red and white currant.

Name.	First bloom.	Ripened.	Vigor (1 to 10).	Productiveness (1 to 10.)	Size (1 to 10).	Quality (1 to 10).	Remarks.
Cherry	May 7	July 10	8	7	10	7	Large, acid.
Fay	" 7	" 10	5	7	10	8	Affected badly by the borers.
Holland	" 7	" 12	9	4	7	6	Unproductive.
London Red							Not fruited.
Moore's Ruby							" "
Moore's Select							" "
North Star							" "
Prince Albert	May 8	" 20	10	9	9	9	Very late, hardy, desirable.
Red Dutch	" 6	" 8	9	10	8	9	Old, still the best.
Versaillaise	" 6	" 8	7	5	10	8	Unproductive.
Victoria	" 8	" 15	10	9	7	7	A popular market variety.
White Dutch	" 8	" 8	7	7	8	10	Best for dessert.
White Gondoin	" 6	" 8	7	7	8	9	Much like the White Dutch.
White Grape		" 8	7	6	9	9	Best white currant.
Wilder							Not fruited for market.

The *Red Dutch* and the *Victoria* are the popular varieties for general planting, both being hardy and productive. The latter is remarkably free from the attacks of the borer, for which reason it is largely used for market plantations. The currant fly will also pass it by if varieties of more tender foliage are planted near.

The *Fay* is a weak grower, of a sprawling habit, and it suffers much from the attacks of borers. These causes combined make it a failure here.

Prince Albert is much later than the Victoria; a rapid, upright grower; young shoots large and strong; bunch short, compact, and well filled; berries medium large and of good quality when fully ripe. It is quite free from the attacks of borers and its tough foliage is objectionable to the currant worm. It does not receive the attention that it seems to deserve. It is said that it is hard to propagate.

The *White Dutch* and the *White Grape* are the best of their class. The white currants are of less acidity than the red, and are very desirable for dessert purposes.

The black currants make a jelly that is highly prized by those who have once used it, and there is a market for a limited quantity of them. They are very little affected by insects and easily grown.

The *Crandall* is undesirable because the berries on the bunch ripen at different times and this makes the labor of picking excessive. The berries are more tart than those of the black currants and larger in size; bushes rampant growers. Unproductive.

GOOSEBERRIES.

What has been said about the general management of the currant applies equally as well to the gooseberry.

Name.	Origin.	First blossom.	Ripened.	Vigor (1 to 10).	Productiveness (1 to 10).	Size (1 to 10).	Quality (1 to 10).	Remarks.
Champion	America							Not yet fruited.
Cluster	"							" "
Columbus	"							" "
Crown Bob	"							Not fully tested.
Downing	"	May 3	July 5	10	8	9	9	A desirable variety.
Golden Prolific	Europe							Not yet fruited.
Houghton	America	May 3	July 8	8	10	6	10	Hardy, productive.
Industry	Europe	" 4	" 10	6	4	8	8	Inclined to mildew.
Lancashire	"							Not yet fruited.
Pale Red	America	May 4	July 10	10	10	7	10	Very productive, hardy.
Pearl	Europe							Not yet fruited.
Smith Improved	America	May 4	July 8	8	7	8	9	
Transparent	Europe	" 5	" 9	6	4	10	8	Mildews.
Triumph		" 5	" 8	6	4	10	9	"

The European varieties produce the largest and best fruit. The mildew to which they are subject, being on the surface, is readily held in check by the use of fungicides. In growing these varieties, especial attention should be given in selecting the location, so that protection is afforded against the heat and drouth. With a good location and suitable care, they are better than the American varieties. The Industry is the most favorably known of the English varieties.

The American varieties are recommended where the conditions are not favorable for the English kinds. Of these the Downing is the best. From the character of the plant it is suspected that this may be a hybrid with some of the Europeans. The bush is drooping, berries quite large, with a fleshy stem, color when ripe is greenish white.

For a market that is not particular, the Houghton and Pale Red are profitable. Both are very hardy, productive, and very seldom affected by mildew.

Houghton is of very small size, bush upright and a medium grower; berry red when ripe. Pale Red is much like the Houghton, but more productive. The bush is of more slender growth and the berries are larger. The bush sets a large number of shoots and needs careful pruning.

R. J. CORYELL.

THE SPRAYING OF FRUITS.

The necessity for the use of insecticides and fungicides seems to increase from year to year. Not only do new insects and diseases appear, to destroy the crops, but the injuries caused by old and well known pests are more noticeable.

For many of them, however, we have quite effective remedies, and, as much light has been given during the past year upon the best methods of applying them, these brief notes are submitted.

Most of the diseases of plants are due to the development of parasitic fungi. These are for the most part microscopic plants, that feed upon the tissues of their hosts, and finally develop spores that answer as seeds for their reproduction, and as they are light and are blown about by the wind, the dissemination of the disease may be very rapid.

These fungi may feed upon the roots, stems, leaves, or fruits of plants, and as they not only rob the plant of food designed for its development, but, by destroying its tissues, hinder the organs of the plants in the performance of their various functions, they exert a two-fold injury.

It has been found that various compounds of copper, zinc, sulphur, iron, etc., will destroy the spores of all fungi with which they may be brought in contact, and by thoroughly spraying the plants with these materials, the spread of the disease can be prevented in many cases. A large proportion of these fungi penetrate to the interior of the plants and there are safe from all applications, except when they push out the slender stalks upon which the spores are borne. It will therefore be seen that for such fungi all remedies must at best be preventive. Many fungi, however, are quite superficial in their workings and can be readily destroyed.

Most of the fungi pass the winter upon the stems, or the fallen leaves and fruit, and only await favorable conditions for germination. Careful experiments have shown that in order to hold the diseases in check, early applications of fungicides are desirable. Thoroughly spraying the trees early in the spring, before the leaves start, with some approved mixture, will destroy all of the spores that may have wintered upon the stem or branches, and all that may fall upon them for several weeks. For most fruits it it is well to repeat the operation as soon as the blossoms have fallen, and a third application at the end of four weeks will frequently be desirable.

Many plants have insects that prey upon them in the early spring, and, by adding a small quantity of some poison, all that eat the foliage can be destroyed, with no expense except for the material used as an insecticide.

From the experiments of the past two years, the following are regarded as among the most effective:

FUNGICIDES.

For all plants that are not injured by the application of lime to the foliage the Bordeaux mixture will be found the most reliable form. It can be used upon all kinds of plants without fear of burning the leaves, but, although the lime itself is of value in cementing the material upon the plants, its presence is unsightly and not always desirable, particularly if any parts of the plants are to be used as food within four or five weeks.

As first made, the Bordeaux mixture contained 16 pounds of copper sulphate and 30 pounds of lime to 22 gallons of water. This made a thick wash that frequently clogged the pump and the nozzle, and was quite expensive. The formula has now been modified so that 4 pounds of copper sulphate and 3 pounds of lime added to 22 gallons of water is the most concentrated mixture made. This should be used for the first application, but it may be reduced for the later ones. Four pounds of copper sulphate and 3 pounds of lime for 32 gallons of water seem as efficacious as a stronger mixture for the second application, and if more than this is used the amount of water could, without the mixture losing any of its virtue, be increased to 50 gallons. For the powdery mildews of the grape, gooseberry, and rose, which live entirely upon the exterior of the plants, the weakest mixture seems entirely effectual.

Two other copper compounds are rather more expensive than the above and are less reliable, but as they are clear solutions they can be used, if necessary, when the fruit or other edible portions are reaching maturity. They are known as modified eau celeste and ammoniacal solution of copper carbonate.

The former is made by dissolving two pounds of copper sulphate in hot water, adding a solution of 1½ pounds of sal soda, and, after all action has ceased, pouring in one quart of ammonia water (26°) and diluting to 32 gallons.

The ammoniacal solution of copper carbonate is made by dissolving precipitated copper carbonate (3 oz.) in ammonia water (one quart) and diluting to 32 gallons with water.

It does not differ from the modified eau celeste, except that the former contains sulphate of soda in solution and is somewhat stronger. If, before adding the ammonia to the modified eau celeste, the copper carbonate formed by the addition of the sal soda to the copper sulphate had been allowed to settle, and, after pouring off the liquid, if the ammonia had then been added, it would be what is known as ammoniacal solution of copper carbonate.

The powdery mildews may be also kept in check by the use of liver of sulphur (potassium sulphide) dissolved in water, using 3 ounces to 10 gallons of water. For the gooseberry and similar mildews this is entirely effectual, and has the decided advantage of being in no way poisonous and of not staining the fruit; it can therefore be used at any time in the season.

The copper sulphate is sold at retail at about 15 cents per pound, but in a pulverized condition can be obtained at about 4 cents per pound f. o. b. New York or Baltimore in barrel lots, and at from 5 to 6 cents for smaller quantities.

One or two of the wholesale dealers expect to locate distributing depots in Michigan the present season, from which small lots can be sent to customers with little expense for freight.

Arrangements have also been made with C. Alsdorf & Son, Lansing, Mich., to supply granulated copper sulphate, with a guaranteed purity of 99 per cent., at the following prices, f. o. b., Lansing:

50 to 100 pounds	5 cents per pound
25 to 50 pounds	6 cents per pound
10 to 25 pounds	7½ cents per pound

Cash must accompany all orders.

INSECTICIDES.

For most purposes, particularly where the insects eat the exposed portions of plants, the chief reliance is still upon Paris green or London purple, although many persons use white arsenic and corrosive sublimate. The last two are very poisonous, and as they closely resemble many common household chemicals, they should be used with great care, if at all.

For many plants, the Paris green or London purple can be used at the rate of one pound to 200 gallons, but for the plum this should be somewhat reduced in strength, while for the peach, Paris green alone in water can hardly be used at any strength without burning the leaves. As a rule Paris green is less likely to burn the foliage than London purple and is rather more effective. It is, however, heavier and more difficult to keep in proper suspension in the water.

Either of these insecticides can be used in combination with Bordeaux mixture at the same strength as when used alone, but are hardly safe to be used in ammonia-containing mixtures, unless a small quantity of lime is added.

The use of lime at the rate of one pound to 32 gallons of water will also be of value when they are used only as insecticides, as it will allow of their application to the plum, cherry, and even the peach, with safety.

Although it may be desirable to use fungicides when there are no *eating* insects upon the plants, it will generally be well to add a small quantity of London purple, say one pound to 250 gallons, if there is any probability of their appearance before another application will be needed.

INSECTS AND DISEASES.

It is not the intention at this time to go into a lengthy description of the structure and life history of the different pests to which our agricultural plants are subject, but it may be of value to have a brief statement of the insects and diseases for which the spraying of our different plants will be remunerative.

THE STONE FRUITS.

The peach, plum, and cherry are extensively grown in this state, and suffer severely from the attack of the curculio and of rot, which destroy both fruit and leaves. The plum is frequently defoliated by the "shot hole" fungus and the peach by the "curl."

While accurate data are not at hand regarding the effect of fungicides upon the development of the "curl" of the peach leaves, it is quite certain that the disease can be, to some extent, kept in check by their use, and there can be no question but that combined Bordeaux mixture and Paris green will save the fruit from the curculio and rot, and will maintain the foliage in a healthy condition until autumn.

While the spraying may not save every plum from rot and curculio, the number lost, in average seasons, will be of advantage in aiding the proper thinning of the fruit. Particularly, if the season is a wet one, an additional spraying of the combined mixture about two weeks after the fruit has set will be of advantage.

POME FRUITS.

The most injurious insects of the apple and pear, for which spraying is of value, are the codlin moth, tent caterpillar, canker worm, and curculio. The scab of the apple and pear, and the leaf blight of the pear and quince are the most destructive fungi for which fungicides are used, and all of them can be to a large degree controlled. Even if the three applications, as recommended, are not given, two can hardly fail to be of value, and with most varieties will pay in average seasons, if the trees are bearing even a light crop of fruit.

THE GRAPE.

In nearly all of the grape-growing sections, the injury either to foliage, fruit, or both, from the downy or powdery mildews, black rot, and anthracnose, is yearly on the increase and of all these diseases the use of the copper mixtures will prevent the spread.

During the past eight years many experiments with dozens of mixtures have been made, with the hope of ascertaining which was most effectual, and in nearly every case the best results were obtained with Bordeaux mixture, which has also the advantage of being inexpensive and easily prepared and applied.

SMALL FRUITS.

The strawberry is frequently troubled by leaf blight and many otherwise valuable varieties are nearly ruined by it. Bordeaux mixture applied early in the spring and again in a diluted form just as the blossoms are falling will hold it in check until after the crop is gathered, when another application will be desirable if the plantation is to be kept for another year.

The raspberry anthracnose soon becomes deeply seated in the canes, and no fungicide can reach it. The spread of the disease can be retarded, however, if the old canes are sprayed just before the leaves start. It will also be well to cut out and burn all canes that are badly infected. The new canes should be sprayed when a half foot high, and should receive a second application at the expiration of two or three weeks.

The currant and gooseberry often lose their foliage from the workings of the currant worm and if this is kept in check the fungi may destroy them.

As soon as the leaves have formed, the combined mixture should be applied and can be repeated to advantage in two or three weeks. Later on, especially for European varieties of gooseberry, an occasional application of liver of sulphur will keep the foliage healthy.

The above are among the most injurious of the fungi and insects that work upon our fruits, but if other similar pests trouble these or any other crop, a judicious use of the remedies enumerated will keep them in check. Sometimes, however, the application of remedies is not feasible, owing to the nature either of the insect or fungus, or of the crop itself.

SPRAYING APPARATUS.

While very crude outfits will answer for the application of the fungicides and insecticides, a small bucket pump will at least be desirable. For use upon gooseberry, grape, and other small plants, a knapsack pump will be of great value, but a strong force pump mounted upon a barrel or tank will be indispensable for orchard spraying. For large orchards, a sprocket wheel and endless chain attachment for working the pump by horsepower will be desirable.

The nozzle used for the Bordeaux mixture should be so constructed that it can be readily cleared in case it becomes clogged. The stream should be broken into a fine spray and for large trees few nozzles can give the necessary force, and at the same time the mistlike spray that is so desirable. The Vermorel nozzle works well upon low plants, and if the mixture has been carfully strained the graduating spray nozzles will do fair work upon large trees. In case they become clogged, however, it is some trouble to clear them. A nozzle is now sold at $2.00, by John J. McGowen, of Forest Home, N. Y., that seems to satisfy the required conditions, and after a thorough trial it is highly recommended by the officers of the Cornell experiment station.

In April, 1892, a bulletin upon insecticides and fungicides was issued. It contained descriptions and illustrations of many of the more injurious fungi, and formulæ for the preparation of a considerable number of insecticdes not mentioned here. A second edition of that bulletin, (No. 83) was printed several months ago and copies will be sent to all applicants who desire more extended information than is given here.

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Horticulturist.

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February 28, 1893.

POTATOES.

AMOUNTS OF SEED.

EXPERIMENTS AT THE MICHIGAN EXPERIMENT STATION, AND THE COMPILED RESULTS OF TWELVE OTHER STATIONS.

No. 93—Farm Department.

CONDENSED SUMMARY OF RESULTS.

The general conclusion from the following bulletin is that the potato growers of Michigan do not plant enough seed. Our own experiments, corroborated by those of other stations, go to show that for ordinary distances the half potato gives better results than any smaller amount. For weak growing varieties, or varieties having small tubers, even a larger amount of seed will be found more profitable.*

A careful investigation shows clearly:

First, That an increase in seed within ordinary limits produces a marked increase, both in total yield and marketable yield.

Second, That an increase in seed, from one eye up to the half potato, produces an increase in the net value of the crop.† But the increased yield from the whole potato over the half potato is not sufficient to cover the cost of the greater amount of seed.

HALF POTATOES VS. TWO EYES.‡

A comparison of the half potato with the two eyes shows:

First, That for total yield (large and small), of 95 experiments, 76 are in favor of the half potato, and 19 in favor of the two eyes;

Second, That for marketable yield (total less small) of 73 experiments, 58 are in favor of the half potato, and 15 in favor of the two eyes;

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* See table LIV, p. 48.

†Value of marketable yield less the value of seed planted.

‡ See table LV, half potato vs. two eyes, p. 49.

Third, That for net marketable yield (marketable less amount of seed) of 30 experiments, 23 are in favor of the half potato and 7 are in favor of the two eyes;

Fourth, That for net value of crop (value of crop less value of seed), of 30 experiments, 22 are in favor of the half potato and 8 in favor of two eyes.

WHOLE POTATO VS. HALF POTATO.*

A comparison of the whole potato with the half potato shows:

First, That for the total yield (large and small) of 54 experiments, 46 were in favor of the whole potato and 8 in favor of the half potato;

Second, That for the marketable potato, of 42 experiments, 36 were in favor of the whole potato, and 6 in favor of the half potato;

Third, That, for the net marketable above seed, of 13 experiments, 7 are in favor of the whole potato, and 6 in favor of the half potato.

That for the net value of crop (value of marketable less value of seed planted), of 12 experiments, 7 are in favor of the whole potato and 5 in favor of the half potato.

INTRODUCTION.

A glance at a table of statistics shows us that the value of the wheat crop in Michigan is $15,000,000; of the potato crop, $12,000,000; of the corn crop, $10,000,000; of the oat crop, $9,000,000. As the potato crop is of such great value to the farmers of Michigan we have carefully compiled the results of a large number of experiments at our own and other stations, hoping that such compilation might throw some light upon the question of amounts of seed, which has been so much experimented upon.

No amount of experimenting will make it possible to lay down any fixed rule, since there are so many varying conditions of soil, of season, and of varieties. But so far as it is possible, or ever will be possible to lay down any fixed rule as to the amount of seed best to plant, it would seem that the question is settled by the remarkable agreement of results obtained under the varying conditions found in Massachusetts, New York and Maryland in the east, Utah and Nevada in the west, Wisconsin, Indiana and Ohio in the north, Georgia and Louisiana in the south, and Tennessee and Kentucky in the central part of the United States. In many of these states, as in New York, Maryland and Ohio, the results have been reached after a series of experiments running through a number of years, and in some cases with a large number of varieties, both early and late.

The results of many of the experiments are misleading, since only the total or marketable yields are given for the different amounts of seed. Almost universally the total and marketable yields increase with the increased amount of seed used: but it frequently happens that the increase in the yield is not sufficient to cover the cost of the greater amount of seed required. For example, we find in every experiment where we are able to compare the wholes and halves, as in Michigan, New York, and Ohio, (See table LVI, p. 49), that the wholes give the greater total yield. But if we average the results from the wholes and halves in the table referred to (p. 49) we get an average of 223 bushels per acre from the wholes and 188 bushels from the halves. The difference in the marketable yield is not so marked, the average from the wholes being 179 bushels per acre, and 166 bushels for the halves.

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* See table LVI, p. 49, Whole potato vs. half potato.

Now if we deduct from the value of the crop in the fall, the value of the seed used in the spring, the result is quite different. Out of the ten experiments as shown in the table (p. 49), 5 are in favor of the half potato, and 5 in favor of the whole potato, with a final average result in net value of a few cents in favor of the half potato. In reality the whole question of amount of seed is not what gives the greatest yield, but what amount gives the greatest profit. When seed is high in the spring it will generally be advisable not to plant whole potatoes at ordinary distances, but when they are very cheap it will generally pay.

In all of our experiments it has been very noticeable that the smaller amounts of seed are unable to overcome unfavorable conditions. In dry seasons there were many vacant hills. On the other hand where very large amounts of seed are used (30 to 60 bushels per acre), if the season is unfavorable and the yield light, the crop is frequently but little in excess of the seed planted. It has also been noticeable that an increase in seed planted, produces a somewhat larger increase in the small potatoes than in the marketable potatoes, but the difference is not very marked.

As will readily be inferred, the cutting out of eyes to plant, or the use of small potatoes for seed is to be condemned. The latter is practiced in some sections of the State by farmers, and not only lessens the profit the first years, but if followed for a series of years will tend towards rapid deterioriation.

The larger amounts of seed give a more vigorous growth of vines, and the crop matures earlier. The potatoes on the whole tuber plats ripen from five to ten days earlier than potatoes on the single eye plats. This has also been noticed at other stations.

The computation of net value of crops is based on the following table of prices, which gives the average prices in fall and spring for the past ten years. The figures in the table were taken from the "Michigan Farmer," and were the prices actually paid for carload lots in the Detroit market during the period of marketing in the fall and in the month of April, preceding the time of planting. The prices received by farmers throughout the State will be somewhat less than those given above, but this will not alter the comparative results. In computing the net value of crop 50c is used for seed and 44c per bushel for crop (marketable yield). Though these figures differ slightly from the actual averages we use them for convenience in figuring, as the variation is too slight to make any material difference in the results. The small potatoes have not been taken into consideration in estimating the value of the crop. Ordinarily they will just about pay for the handling. If any farmer considers that, they have any value above handling, he can add the same to the net value of the crop.

Table I.—*Table of prices.*

Crops of	Average per bushel for Sept. and Oct.	Average per bushel for April.	
1882	$0.4775	$0.63	1883
1883	.4725	.32	1884
1884	.3375	.42	1885
1885	.3575	.40	1886
1886	.4775	.52	1887
1887	.6775	.89	1888
1888	.3325	.155	1889
1889	.4050	.49	1890
1890	.6200	.99	1891
1891	.3100	.25	1892
1892	.7000		
Average price	$0.4451	$0.50⅔	

ACKNOWLEDGMENTS.

In submitting this bulletin to the farmers of the State, we wish to, acknowledge the valuable assistance of Mr. W. L. Harvey, class of '93, who has aided us by his careful compilation of the results of the experiments of our own and other stations, as given in these tables.

We are further indebted to Messrs. E. M. McElroy, and E. B. Hale, class of '93, for their accurate work in conducting the experiments of 1891, and to Messrs. C. J. Barnum, W. J. McGee, and H. E. Ward for the experiments of 1892.

MICHIGAN—FARM DEPARTMENT.

EXPERIMENT

BY E. M. McELROY (CLASS OF '93), 1891.

Conditions of the experiment:

Soil, a sandy loam.

Variety, Burbank.

Time of planting, June 12.

Amounts of seed, one eye, fourth potato, half potato, whole potato.

Method of planting, one piece was placed in a hill, the hills being 33 inches apart each way, and the plat was divided lengthwise into three divisions so that mulch was applied to the first division, the second was cultivated in the ordinary way, the third had mulch applied in the hill. The plat was 16 rods long by two rods wide.

TABLE II.—*Comparative yields.*

Seed.		Mulched.	Cultivated.	Mulched in hill.	Average for three divisions.
One eye	Total	92	101	70	88
	Small	7	8	13	10
	Marketable	85	93	57	78
Fourth potato	Total	196	208	139	181
	Small	26	22	14	21
	Marketable	170	186	125	160
Half potato	Total	198	224	186	203
	Small	22	38	31	30
	Marketable	176	186	155	173
Whole potato	Total	220	221	195	212
	Small	37	28	23	29
	Marketable	183	193	172	183

TABLE III.—*Comparative values.*

Seed.	Total yedld.	Small.	Large.	Amount of seed planted.	Net large, above seed.	Value of large.	Cost of seed.	Net value of large.
One eye	88	10	78	2.7	753	$34.32	1.35	$32.97
Fourth potato	181	21	160	6	154	70.40	3	67.40
Half potato	203	30	173	12	161	76.12	6	70.12
Whole potato	212	29	183	24	159	80.52	12	68.52

A study of the table yields shows in the first and third divisions, a very marked increase in both total and marketable, from the smallest to the largest amounts of seed. The results in the second are practically the same, for though the total yield for the half potato was three bushels greater than that for the whole, the marketable yield for the whole was greater by seven bushels. Thus in every case the one eye cutting gives the poorest yield and the whole potato the best. The average for the three divisions shows decisively this increase, figures for the averages of marketable being 78, 160, 173, 183 bushels per acre respectively. The great similarity of results under the different methods of treatment, is a striking feature.

It will be noticed that the per cent of small potatoes is lower with the smaller amounts of seed.

We have had occasion to notice the fact (page 5) that this increased yield does not necessarily mean an increased profit, since the increased cost of the larger amounts of seed must be considered.

Yields are given in bushels per acre unless otherwise mentioned. In all Michigan experiments average sized potatoes were used unless otherwise stated. In the experiments which have been conducted on the farm department every precaution has been taken to secure uniform conditions for all the different amounts of seed planted. In every case several rows of potatoes have been planted around the border of the experiment.

In the case of the whole potato (table III), we see that the greater yield was not sufficient to counterbalance the extra amount of seed. Up to the whole potato there is a decided increase in net yield, but the net profit, $32.97, $67.40, $70.12, $68.52, does not differ greatly in case of the three larger cuttings. It will be noticed that the best profit, viz., $70.12, was obtained from the half potato cuttings of seed.

EXPERIMENT

BY E. B. HALE (Class of '93), 1891.

Conditions of the experiment:

Soil, the experiment was duplicated, one being on sand and the other on clay.

Varieties, Rural New Yorker No. 2 and Pearl of Savoy.

Time of planting, June 5.

Amounts of seed, one eye, two eyes, half potato, whole potato.

Method of planting, hills and drills were used and two pieces were put in a hill, while only one piece was put in a place in the drills; the hills were 33 inches apart, the drill rows were 33 inches apart and the pieces were 16½ inches apart in the row; the aim was to plant the same amount of seed in the hills as in the drills.

The plat was 2x16 rods in extent. Several rows of Pearl of Savoy and mixed varieties were planted around the outside.

TABLE IV.—*Yields, Pearl of Savoy.*

Seed.		Clay.		Sand.		Average.
		Hills.	Drills.	Hills.	Drills.	
One eye.	Total	35	40	69	147	72
	Small	5	3	3	32	11
	Large	30	37	66	115	61
Two eyes.	Total	53	75	72	144	85
	Small	3	5	3	3	3
	Large	50	70	69	141	82
Half potato.	Total	83	109	96	141	107
	Small	8	10	21	32	19
	Large	75	99	75	109	88
Whole potato.	Total	**147**	**168**	**179**	**197**	**173**
	Small	21	19	48	48	35
	Large	**126**	**149**	**131**	**149**	**138**

TABLE V.—*Values, Pearl of Savoy.*

Seed.	Total yield.	Small.	Large.	Amount of seed planted.	Net large above seed.	Value of large.	Cost of seed.	Net value of large.
One eye	72	11	61	5.4	55.6	26.84	2.70	$24.14
Two eyes	85	3	82	10.8	71.2	36.08	5.40	30.68
Half potato	107	19	88	24	64	38.72	12	26.72
Whole potato	**173**	35	**138**	48	**90**	60.72	24	**36.72**

In the Pearl of Savoy the same thing is shown as in the foregoing, viz., that there is a gradual increase in both total and marketable as we go from the smaller to the larger amounts of seed. The only exception is seen in the "drills on sand." Even here the yield from the whole potato far exceeded that from any other.

The net profits are somewhat different from those noted in the preceding experiment. Here the largest profit is obtained from the greatest amount of seed, while the one eye gives the least profit. The two eyes come second. The difference in favor of the large amount of seed is very marked.

TABLE VI.—*Yields, Rural New Yorker, No. 2.*

Seed.		Clay.		Sand.		Average.
		Hills.	Drills.	Hills.	Drills.	
One eye.	Total	213	232	219	256	229
	Small	5	5	16	5	8
	Large	208	227	203	251	221
Two eyes.	Total	**251**	216	**280**	**344**	**272**
	Small	8	3	16	3	8
	Large	**243**	213	**264**	**341**	**264**
Half potato.	Total	221	237	**280**	293	259
	Small	8	3	21	5	11
	Large	213	234	259	288	248
Whole potato.	Total	227	**267**	261	304	264
	Small	13	11	21	56	24
	Large	214	**256**	240	248	240

TABLE VII.—*Values, Rural New Yorker No. 2.*

Seed.	Total yield.	Small.	Large.	Amount of seed planted.	Net large above seed.	Value of large.	Cost of seed.	Net value of large.
One eye	229	8	221	5.4	215.6	$97 24	$2 70	$94 54
Two eyes	**272**	8	**264**	10.8	**253.2**	116 16	5 40	**110 76**
Half potato	259	11	248	24	224	109 12	12 00	97 12
Whole potato	264	24	240	48	192	105 60	24 00	81 60

The Rural New Yorker No. 2 is the most variable of all that we have yet had. It will be noticed that the two eye cuttings gave the largest yield in three out of four instances. If we exclude them, we find the same regular increase from the smallest to the largest cutting of seed.

If we were to consider this experiment alone, we might be led to believe the two eye cuttings to be most profitable of all, whereas this is disproven by almost every other experiment conducted upon our department. The large yield from the two eye pieces is one of those erratic conditions that often result in experiments of this kind. It shows the need of many experiments under varying conditions in order to establish a scientific truth.

We find the variation from our other results even more strongly emphasized in the table of relative profits. Here the two eyes are most profitable, with the half second, the one eye third and the whole least of all.

EXPERIMENT.

BY C. J. BARNUM AND W. J. McGEE, 1892.

Conditions of the experiment:

Soil, a sandy loam.

Varieties, Early Ohio and Rural New Yorker No. 2.

Time of planting, May 31, 1892.

Amounts of seed, one eye, two eyes, half potato, whole potato.

Method of planting, the experiment was repeated in hills and drills. Two pieces were put in a hill and one piece was put in a place in the drills. The hills were 33 inches apart each way, the pieces being 16½ inches apart in the drill row.

Size of the plat, 4x16 rods.

The experiment was repeated three times with each variety in both hills and drills.

TABLE VIII.—*Yields, Early Ohio.*

Seed.		No. 1.		No. 2.		No. 3.		Av. for the three hills and drills experiments.
		Drills.	Hills.	Drills.	Hills.	Drills.	Hills.	
One eye	Total	124	98	140	158	117	145	130
	Small	47	51	39	32	26	53	41
	Marketable	77	47	101	126	91	92	89
Two eyes	Total	159	109	140	181	219	230	173
	Small	53	40	35	53	34	51	44
	Marketable	106	69	105	128	185	179	129
Half potato	Total	216	161	195	195	329	268	227
	Small	97	58	70	56	62	67	68
	Marketable	119	103	125	139	267	201	159
Whole potato	Total	229	267	225	264	390	262	273
	Small	90	107	79	88	83	97	91
	Marketable	139	160	148	176	307	165	182

TABLE IX.—*Values, Early Ohio.*

Seed.	Total yield.	Small.	Large.	Amount of seed planted.	Net large above seed.	Value of large.	Cost of seed.	Net value of large.
One eye	130	41	89	5.4	84	$39 16	$2 70	$36 46
Two eyes	173	44	129	10.8	118	56 76	5 40	51 36
Half potato	227	68	159	24	135	69 96	12 00	57 96
Whole potato	273	91	182	48	134	80 08	24 00	56 08

The results from the Early Ohio are practically identical with those of former years. There is a general increase of yield as we go from the smaller to the larger cuttings of seed. This is true in five cases out of six in the above table. It is needless to dwell on the figures, as the conclusion is obvious from the tables.

The next profits in this also show a gradual increase up to the half potato. The difference between the half and whole is not great, being but $1.88 in favor of the half.

TABLE X.—*Yields, Rural New Yorker No. 2.*

Seed.		No. 1.		No. 2.		No. 3.		Average for the hills and drills on the three experiments.
		Drills.	Hills.	Drills.	Hills.	Drills.	Hills.	
One eye.	Total	188	139	293	265	259	291	239
	Small	93	59	29	49	43	34	51
	Marketable	95	80	264	216	216	257	188
Two eyes.	Total	265	257	280	244	200	204	242
	Small	123	115	65	83	61	55	84
	Marketable	142	142	215	161	139	149	158
Half potato.	Total	441	449	284	203	324	251	325
	Small	143	128	109	83	88	85	106
	Marketable	298	321	175	120	236	166	219
Whole potato.	Total	541	499	291	277	352	287	375
	Small	132	113	112	109	103	105	112
	Marketable	409	386	179	168	249	182	263

TABLE IX. —*Values, Rural New Yorker No. 2.*

Seed.	Total yield.	Small.	Large.	Amount of seed planted.	Net large, above seed.	Value of large.	Cost of seed.	Net value of large.
One eye	239	51	188	5.4	183	$82 72	$2 70	$80 02
Two eyes	242	84	158	10.8	147	69 52	5 40	64 12
Half potato	325	106	219	24	195	96 36	12 00	84 36
Whole potato	375	112	263	48	215	115 72	24 00	91 72

The Rural New Yorker No. 2, as was the case last year, did not show uniform results. Yet, in three of the six individual cases, the same increase is shown. The general average also shows this increase, the marketable averagesbeing 188, 158, 219, 263.

The column of net profits presents one striking feature, viz., the fact that the profits in this case are largest for the greatest amount of seed. The difference in its favor is very marked. The half comes second and the one eye third. The two eyes, which were far ahead of all the rest last year in this variety, show the least profits of all for this season.

EXPERIMENT WITH LARGE vs. SMALL POTATOES FOR SEED, 1892.

BY H. E. WARD (CLASS OF '95), 1892.

Conditions of the experiment:

Soil, a sandy loam.

Varieties, Empire State, Early May Flower, Rural New Yorker No. 2.

Time of planting, June 11, 1892.

Amounts of seed: The small potatoes were about the size of a hen's egg; just under marketable, but not the smallest. The large potatoes were the largest to be had in that variety. The Rural New Yorker No. 2 was cut with two eyes in each piece and two pieces were put in a hill. In each of the other varieties every hill contained a half potato.

Method of planting. The planting was done in hills 33 inches apart each way, and at a depth of about 4 inches.

TABLE XII.—*Large vs. small potatoes for seed.*

Varieties used and amounts of seed.	Total yield.	Small.	Large.	Amount of seed planted.	Net large above seed.	Value of large.	Cost of seed.	Net value of large.
EMPIRE STATE.								
Half of small potato....	195	39	156	*(6)	156	$68 64	$0 60	$68 04
Half of large potato....	**236**	43	**193**	16	**177**	84 92	8 00	**76 92**
EARLY MAYFLOWER.								
Half of small potato....	147	19	128	*(6)	128	56 32	60	55 72
Half of large potato....	**191**	33	**158**	16	**142**	69 52	8 00	**61 52**
RURAL NEW YORKER No.2.								
4 eyes of small potato...	160	26	134	*(7.2)	134	58 96	72	58 24
4 eyes of large potato...	**192**	9	**183**	17	**166**	80 52	8 50	**72 02**

* The small potato seed is figured at 10 cents per bushel, just about what it would cost to keep the seed over, nothing is deducted from the marketable to get the net yield. It would be manifestly unfair to deduct them from the marketable.

The table shows a gain for the large seed in every instance, for both marketable yield and net profit. The difference was no slight one, being $8.88 for the Empire State, $5.80 for the Early Mayflower, and $13.78 for the Rural New Yorker No. 2.

By reference to the notes on this experiment we find that the potatoes from the large seed were of better quality and were earlier matured than those from the small seed. This experiment, in itself, shows that it does not pay to plant small potatoes, even if they are of little value. A very high price of seed might justify the course for one year.

EXPERIMENTS WITH DIFFERENT AMOUNTS OF SEED, 1885-88.

From Bulletin 46 we take the published results of four years' experiments conducted by Prof. Johnson, formerly professor of agriculture here. The distance apart is not given, nor is the size of the plats.

Since neither the amount of seed nor the distance apart of the hills is given, it is impossible to make out a table showing net profits. The column of averages shows that the best yield resulted from the whole potato, and the poorest from the smallest cutting:

TABLE XIII.—*Results for four years experiments, 1885-88.*

Seed.	Yield in pounds.				Average for four years.	Average per cent of small.
	1885.	1886.	1887.	1888.		
One eye	104	144	50	162	115	20
Two eyes	144	**253**	71	172	116	16
Three eyes	186	197	86	212	170	13
Half potato	182	227	91	168	167	18
Whole potato	**188**	193	**117**	**232**	**183**	24

HORTICULTURAL DEPARTMENT.

Prof. Taft, of the horticultural department of our station, has done considerable work along this line. From Bulletin No. 85 (April, 1892), we condense his results. The conditions of the first set of experiments are given as follows:

"The seed was prepared as in previous years, by cutting the tubers lengthwise, and using one piece on the plat for halves; the other was again cut lengthwise and one piece used as a quarter, and this was kept up until we had secured halves, quarters, eighths, and single eye pieces, from the same tubers. An equal number of whole tubers of each variety was planted to ascertain the yield from the whole large tubers." "Naturally being earlier, and more forward in their development when the hot weather came, we could expect a somewhat larger yield from the large tubers than from the small ones, but this could not account for the very *marked* increase."

The results are here tabulated:

TABLE XIV.—*Yields from two varieties.*

Seed.	Clark's No. 1.				Beauty of Hebron,				Marketable average for two varieties.
	No. of eyes in seed.	Yield in bushels.	Marketable.	Small.	No. of eyes in seed.	Yield in bushels.	Marketable.	Small.	
Single eyes	33	65	50	15	33	62	47	15	48
Eighth potato	83	95	73	22	68	63	42	22	57
Quarter potato	120	127	80	47	128	77	40	37	60
Half potato	268	186	105	82	254	160	104	56	104
Whole potato	459	**234**	**130**	104	461	**245**	**180**	65	**155**

The conclusion drawn is: "The total yield in bushels per acre will be seen to be four times as much from the whole tubers as from this single eyes, with a gradual but regular decrease of yield as the size of the seed decreased. There was less difference in the yield of marketable tubers, but the average yield was more than three times as great. As is usually the case, also, the yield of small tubers was in proportion to the size of seed pieces used."

TABLE XV.—*Profits from the marketable average for three years.*

Seed.	Marketable.	Amount of seed planted.	Net large above seed.	Value of large.	Cost of seed.	Net value of large.
Single eyes	100	4.3	96.7	$44 00	$2 15	$41 85
Eighth potato	121	7.5	113.5	53 24	3 75	49 49
Fourth potato	135	14.7	120.3	59 40	7 35	52 05
Half potato	169	28.6	**140.4**	74 36	14 30	**60 06**
Whole potato	**178**	58.9	119.1	78 32	29 45	48 87

We quote conclusions as to yields: "The average *yield* for the three years gives about the same results, except that the past season, for the reason given, was unusually favorable for the whole tubers." As to profits, the single eyes gave least of all, and next to these came the *whole potato*; these were slightly exceeded by the eighth potato. The profit from the quarter potato was somewhat greater than that from the eighth, but the half gave by far the greatest profit of all. It will be observed that the quantity of seed used was larger than in most of our other experiments.

An experiment for the purpose of determining the best distance apart was reported in the same bulletin. Since the results throw some additional light on this question of amount of seed, we have inserted the results as given together with the net profits.

TABLE XVI.—*Yields and profits at different distances.*

	Seed.	Total yield.	Small	Large.	Amount of seed planted.	Net large, above seed.	Value of large.	Cost of seed.	Net value of large.
1 foot.	Eyes weighing 2¼ lbs.	92.	20.	72.	9.9	62.1	$31 68	$4 95	$26 73
	Quarters weighing 4 lbs.	130.	27.	93.	17.6	75.4	40 92	8 80	32 12
	Halves weighing 6½ lbs.	**158.**	45.	**113.**	28.6	**84.4**	49 72	14 30	**35 42**
1½ feet.	Eyes weighing 15 oz.	79.7	17.	62.7	4.12	58.58	$27 59	$2 06	$25 53
	Quarters weighing 2½ lbs.	129.8	37.4	92.4	11.	81.4	40 66	5 50	35 16
	Halves weighing 5 lbs.	**163.9**	49.5	**114.4**	22.	**92.4**	50 34	11 00	**39 34**
2 feet.	Eyes weighing 10-16 lbs.	26.9	3.8	23.1	2.75	20.35	$10 16	$1 38	$8 78
	Quarters weighing 1 10-16 lbs.	117.	24.7	92.4	7.15	85.25	40 66	3 58	37 08
	Halves weighing 3 lbs.	**129.7**	14.8	**114.9**	13.2	**101 25**	50 56	6 60	**43 96**
2½ feet.	Quarters weighing 2⅛ lbs.	88.5	12.9	75.6	4.67	70.9	$33 26	$2 34	$30 92
	Halves weighing 5¼ lbs.	**129.2**	20.3	**108.9**	11.5	**97.4**	47 92	5 75	**42 17**
Average of the above.	Eyes	66.3	13.6	52.7	5.55	47.15	$23 19	$2 76	$20 43
	Quarters	116.3	28.	88.3	10.11	78.19	38 85	5 06	33 79
	Halves	**145.2**	32.5	**112.7**	21.72	**90.97**	49 59	10 86	**38 73**

What is particularly striking is that for every distance apart the same increased yield with the greater amount of seed is shown; that whatever the distance taken, the single eye gives the smallest yield, the quarters show a marked increase, and the halves are far ahead of either.

What is true of the yields is true of the net profits. The results are most decidedly in favor of the half potato, which was the largest amount of seed used. In the averages we have as the yield of the marketable 52.7, 88.3, and 112.7 bushels per acre. As to net profits, the averages are $20.43, $33.79, $38.73, or nearly twice as much for the half potato as for the single eyes.

AMOUNTS OF SEED AND PRICES.

It may be interesting to note the variation of spring and fall prices in the different years. In the spring of 1891, the price of potatoes reached the highest point in the period of eight years, viz.: ninety-nine cents per bushel. In the fall the price dropped to thirty-one cents, being the widest range of prices for any of the eight seasons. As we have before mentioned, such a condition would largely determine the relative profits from different amounts of seed. We have added a table showing the profits from this experiment, using the prices which prevailed in the year in which this experiment was conducted. (See table III.)

TABLE XVII.—BURBANKS.—*Table showing net profits for 1891 prices.*

Seed.	Large.	Amount of seed planted.	Net large above seed.	Value of crop.	Cost of seed.	Net value of crop.
One eye	78	2.7	75.3	$30.18	$2.67	$27.51
Quarter potato	160	6	154	49.60	5.94	43.66
Half potato	173	12	161	53.63	11.88	41.75
Whole potato	183	24	159	56.73	23.76	32.97

The quarter potato gives the largest net profit, with the half potato next. The one eye is the lowest, but the whole potato, which gives the largest marketable yield, stands third in the net profit.

It must be remembered that this was an exceptional season, and that when the price is very high in the spring it is likely to be far lower than the average in the fall.

Last season the prices varied widely from the average, and a table was given showing the relative profits at the prices actually ruling at that season. The spring prices for that time were more than three times those in the fall. This season the conditions were reversed, and while the seed could be bought for twenty-five cents in the spring, the crop commanded seventy cents in the fall. We exhibit the relative profit of the Early Ohio in Mr. McGee's experiment (page 12) with the actual prices for '92, to show a variation of the opposite direction. (See table IX.)

TABLE XVIII.—EARLY OHIO.—*Table showing net profits for 1892 prices.*

Seed.	Large.	Amount of seed planted.	Net large above seed.	Value of crop.	Cost of seed.	Net value of crop.
One eye	89	2.7	86.3	$62 30	$0 67	$61 63
Two eyes	129	5.4	123.6	90 30	1 35	88 95
Half potato	159	12	147	111 30	3 00	108 30
Whole potato	182	24	158	127 40	6 00	121 40

There is a decided increase in the profits all along the line. The profits from the whole potato are nearly twice as great as those for the one eye. We have previously mentioned the fact that the prices seem to run to extremes; that is, when the spring price is low the price in the fall is almost certain to be high, and *vice versa.* This fact considered in connection with the above table would seem to indicate that it is profitable to plant whole potatoes when their price is low.

NEW YORK.

FROM "THE NEW POTATO CULTURE."

BY E. S. CARMAN.

The following tables and notes are taken from Mr. E. S. Carman's admirable little book on "The New Potato Culture." Special attention is called to Mr. Carman's remarks on amounts of seed.

TESTS WITH DIFFERENT NUMBERS OF EYES TO THE PIECE.

Conditions of the experiment:
Variety, Improved Peachblow and White Star.
Amounts of seed, one eye, two eyes, three eyes, four eyes.
Method of planting, strong eyes, in hills 1 foot by 3 feet apart.

TABLE XIX.—WHITE STAR.—*Different numbers of eyes to the piece.*

Seed.	Total yield.
One eye	171.45
Two eyes	252
Three eyes	282.50
Four eyes	322.86

TABLE XX.—IMPROVED PEACHBLOW.—*Different numbers of eyes to the piece.*

Seed.	Total yield.
One eye	171.45
Two eyes	252
Three eyes	292.50
Four eyes	322.66

DIFFERENT SIZED PIECES WITHOUT REGARD TO NUMBER OF EYES.

Conditions of the experiment:
Amounts of seed, small potatoes cut into four pieces, into halves, and whole potatoes;
Method of planting, trenches.

TABLE XXI.—*Different numbers of eyes to the piece.*

Seed.	Total yield.
One-quarter potato	230.41
One-half potato	256.66
Whole potato	278.66

"It will be seen that the whole seed gave 48 bushels per acre more than quarter pieces and 22 bushels more than half pieces. But the number of unmarketable potatoes increased with the size of the seed, the whole pieces giving the greatest number, and the half pieces next, and the quarter pieces fewest."

"*Potato skins cut to single eyes*, May 26th were planted in well prepared ground, 37 pieces of potato skins, each having a single strong eye, 6 inches apart in the drill. The 37 pieces weighed two ounces. Three grew and the yield was half a dozen potatoes as large as marbles. The experiment was made to test the value of a positive assertion on the part of a 'well-known' farm writer that such eyes would yield as well as those to which flesh is attached."

"EXPERIMENT TO DETERMINE HOW MUCH FLESH EACH EYE SHOULD HAVE WHEN PLANTED TO PRODUCE THE MOST PROFITABLE CROP."

"*Test 46 A.* The seed potatoes were selected all of the same size, and peeled, all eyes being cut off except the strongest near the middle—that is, whole potatoes were peeled so that but one eye was left with a ring of skin about it. It would be equivalent to cutting out all the eyes but one, and then planting the whole potato as if it were a seed piece with a single strong eye. The variety was the Peerless; the amount of chemical potato fertilizer used was 1,000 pounds per acre. They were planted one piece (4 inches deep) every foot in trenches (spade wide) 3 feet apart; cultivation flat. The yield was at the rate of 806.66 bushels to the acre. The best five weighed 3 lbs. 3 ozs. There were of large and small potatoes at the rate of 140,560 to the acre, or 9⅔ to hill.

"*Test 47 A.* The pieces were cut as shown by figure 3, and of that size. They were planted, as in 46 A, 3 inches deep. So many of the pieces either failed to sprout, or died after the sprouting, that no estimate could be made of the yield per acre.

"*Test 48 A.* In this test cylindrical pieces were cut through the potato, with a strong eye upon one end, and planted 4 inches deep. The yield was at the rate of 211.75 bushels to the acre. Of large and small there were at the rate of 87,120 potatoes to the acre, or six to a hill.

"In order to ascertain how much flesh should be left to an eye or to the eyes of seed pieces, it would doubtless be necessary to repeat the tests hundreds of times in different soils, and with different varities. 'Enough is as good as a feast,' but what would be enough in a wet spring might prove too little in a dry one; what might serve in rich soil might prove insufficient in a poor soil. The quantity of flesh which should go with each piece, is, theoretically, that which without unnecessary waste, will best support the eyes until, by the growth of the roots, support from the flesh is no longer required."

"SHALL THE DISTANCE APART OF THE SEED PIECES PLANTED BE PROPORTIONATE TO THE SIZE OF THE SEED?"

Conditions of the experiment:

Soil, an impoverished clay loam which was fertilized with Mapes' potato fertilizer, 1,000 pounds per acre.

Method of planting, The pieces were placed in trenches four inches deep and three feet apart, measuring from the middle of each, on a plot of 1-40 of an acre, thirty-three feet square.

TABLE XXII.—*Shall the distances apart of the seed pieces be proportionate to the size of the seed.*

Seed.	Total yield.
132 pieces 1 eye, 3 in. apart	187
66 " 1 " 6 " "	209
66 " 2 eyes, 6 " "	227.33
33 ½ potatoes, 12 in. apart	227.33
33 whole potatoes, 12 " "	282.33

"It appears, therefore, that whole potatoes of medium size, placed one foot apart, in trenches three feet apart, yieled over 95 bushels per acre more than single eye pieces placed three inches apart; 73 bushels more than single eye pieces placed six inches apart, and 55 bushels an acre more than either two eye pieces or half potatoes."

"*Again. As to the size of seed pieces.* I beg to remark here that my experiments during the past fifteen years ought to throw some light upon the important question of the size of seed. As a result, my belief is that no one can say or will *ever be able to say*, whether it is better to use whole potatoes or any given number of eyes, or sizes of pieces, as a guide for all potatoes and different soils. The number of sprouts desirable to have in a hill depends to a great extent upon the distance apart of the hills, and upon the vigor of the vines.

"Last year I dug up seed pieces of different varieties planted ten days previously. Any one who will do this at such a time will find that the size of the seed must be determined by the *number* and *vigor* of the eyes."

For example, the R. N. Y. No. 2 has not only few eyes, but those of the seed end alone were pushing, notwithstanding the seed potatoes had been exposed to the light and heat for a week or more before planting. Half pieces of this variety were planted. My No. 3 has also few eyes, yet from every eye planted a sprout was growing. Does it not follow that smaller pieces of the No. 3 than of the No. 2 should be planted? The Everitt potato has many eyes, and a peculiarity is that all seem equally sensitive or ready to grow.

"Let us take 50 different varieties of potatoes—all of the same size—and cut them to two eyes. We shall find that some of the varieties will give a perfect stand, and yield a large crop of marketable potatoes, while others will give a very imperfect stand and a poor yield. The same will be the case if the whole seed is planted. Some varities will send up a dozen shoots, others only a few. The yield of the one may be a large crop of small potatoes; of the other, a large crop of large potatoes. The farmer can judge what sized seed to plant, when he sees and knows his potato, how the seed has been kept, and how it will act in his soil, and not until then—and there is no experiment station that can tell him.

"My experience has led me to answer all the inquiries: '*Use large size pieces containing two or three strong eyes*,' and that is the nearest I can come to any fixed rule.

"The advice to use 'whole seed' is very bad indeed. I feel assured if followed out with certain varieties, a yield of small tubers will result every time, while with other varieties the advice may be as sound as a silver dollar.

"The results at certain experiment stations, as well as my own, which show that the best yields come from whole seeds, prove simply that seed of some varieties, preserved in a certain way, and planted in a certain soil and situation, will give the largest crops for the particular varieties tried, and they prove nothing more."

EYES ON THE SEED END AND STEM END COMPARED.

"We have found that in many varieties the eyes from the 'seed end' are the only buds which do push, either in the cellar or *when planted*. The 'eyes' of the other parts seem 'blind' or impotent. The pieces rot in the ground. With other varieties every 'eye' will sprout, though those of the 'seed-end' are almost always the strongest and the first to sprout.

"Hence it would appear that the size of the 'seed' to be planted should be determined by the habit, so to speak, of the variety and not by any fixed rule as to one, two, three eyes, half or whole seed. Hence it is, too that reports of experiments to settle this vexed question are so contradicted. We will guarantee that an experiment of this kind with my No. 2 seedling would show that one-quarter of each tuber, including the 'seed-end' would give a greater yield than three-quarters of the tuber *without* the 'seed-end.' And we are further confident that if the seed of this variety were cut in halves, one-half being 'seed-end' the other 'stem-end,' the stem halves would fail to sprout in about six cases out of seven. Again, if we were using Wall's Orange or any other similar variety having many and prominent eyes, we should reject the seed-end and cut the rest to two or three eyes, depending upon the size of the seed tubers.

"The loss of the yield from 'missing' hills is not well considered. In many a thrifty field of potatoes it is not uncommon to find 20 per cent of missing hills. One-fifth of the crop is thus sacrificed; or if the actual yield be 200 bushels to the acre, the loss would be 50 bushels."

PRICES FOR SPRING AND FALL.

Through the courtesy of Prof. I. P. Roberts, director of the Ithaca station, we are enabled to present a table showing the prices of potatoes for spring and fall in New York state for the past seven years.

TABLE XXIII.—*Prices of potatoes in New York for fall and spring, 1886 to 1892.*

Fall.		Spring.	
1886	$0.35	1887	$0.20
1887	30	1888	50
1888	32	1889	60
1889	35	1890	25
1890	50	1891	1.10
1891	32	1892	30
1892	40		
Average	$0.36	Average	$0.49

GENEVA STATION.

First annual report, 1882.

"A great loss of plants occurred in the case of the small eyes used as seed, and quite a wide discrepancy in time of vegetation occurred in all the rows."

"We note as proven, that under circumstances of field culture, when the character of the soil is unfavorable, the use of single eyes cut shallow, that is, all eyes containing but small portion of potato skin and substances, is not to be recommended. Our crop from this seeding was a failure both in respect to the number of seed which vegetated and in the yield of those that vegetated. Single eyes cut so as to include the prolongation of the eye into the substance of the potato yielded an average of eighty-two bushels per acre, while ordinary half potato seed produced eighty-six bushels per acre."

Second annual report, 1883.

"In plats 1 B, one to five, each of 1-10 acre area, three rows were planted with single eyes, three with cut potatoes, and three with whole potatoes. The yield of each of the thirtieths of an acre was as below. The variety, White Star. The summary of the yields in bushels per acre is:

TABLE XXIV.—*Whole potatoes vs. cuttings.*

Seed.	Total yields.	Small.	Large.
Single eyes	188	30	158
Ordinary cuts	248	43	205
Whole potatoes	323	74	249

"We have another trial between whole potatoes and single eyes."

TABLE XXV.—*Whole potatoes vs. single eyes.*

Seed.	Total yield.	Small.	Large.
Single eyes	190.1	29.3	160.8
Whole potatoes	323.9	142.6	181.3

"Reviewing these figures as a whole, we observe that the proportion of small potatoes is less from single eyes.

"Despite the apparent result in favor of whole potatoes, as shown not only by the totals, but by each separate trial, we cannot but notice that even on the highly fertilized plots of 1882, the yield was below that obtained from single eyes in some of the other plats, while in the case of the whole potatoes used as seed, the yields in plat 1 B, five were the maximum of all our trials. In view of this observation, as also of the uncertainty attending plat experiments, we must consider our results as inconclusive for the purposes of generalization, and conclusive only in the fact that, under the conditions of planting and soil, ordinary cuts and whole potatoes showed a marked superiority in crop over the single eyes used as seed."

"WHOLE TUBERS VS. CUTTINGS FOR SEED."

Eighth annual report, 1889.

"The seed tubers used were of the White Star variety which has been grown at the station for several years. These were planted as whole tubers, half tubers, three-eye cuttings, two-eye cuttings, and one-eye cuttings, and with equivalent weights of seed in all rows in which the form was alike. These five different methods of seeding were arranged in single rows in the order given above, and the set of five rows repeated on each plat. Thus every twentieth acre plat consisted of two rows of each form of seed. When a full stand was obtained each row contained thirty-three hills. Where any hills were missing, the average of those harvested has been taken as their probable yield, and each is thus calculated to a full stand.

"In order to show the proportion of a full stand secured by each form of seed, the per cent of hills which were missing at harvest is shown in the following exhibit:

	Whole tubers.	Half tubers.	Three eyes.	Two eyes.	One eye.
Per cent of hills missing	0.0	0.15	0.45	0.90	4.70"

We subjoin a table compiled from the results as given in the report with profits figured on the basis of the average prices as given in the table on page 8.

TABLE XXVI.—*Whole tubers vs. cuttings for seed.*

Seed.	Total yield.	Small.	Large.	Amount of seed planted.	Net large above seed.	Value of crop.	Cost of seed.	Net value of crop.
One eye	55	4	51	1⅔	49⅓	$18 36	$0 82	$17 54
Two eye	93	6	87	3⅓	83⅔	31 32	1 63	29 69
Three eye	115	7	108	6⅔	101⅓	38 88	3 26	28 06
Half tuber	173	19	154	16	138	55 44	7 84	47 60
Whole tuber	212	23	189	32	157	68 04	15 68	52 36

On the yields little comment is necessary. As to profits, the figures are just as decidedly in favor of the heavy seeding. The difference between the net value of the yield from the half and whole is not great, but the net yields from the whole are about three times as great as from the single eyes.

"On the B plats the seeding was lighter in the three forms where the largest amount of seed was used, and at the same rate for two and one eye seed. This change was made necessary because the supply of larger tubers of even size was used up and a smaller grade was necessarily used for seed.

"The B plats were double the size of the F plats, each being 1-10 acre. Hence the area covered by this experiment is ½ acre on the F plats, or 1-10 to each form and different amount of seed, and one acre on the B plats or 1-5 acre for each different amount of seed."

TABLE XXVII.—*Whole tubers vs. cuttings for seed.*

Seed.	Total yield.	Small.	Large.	Amount of seed planted.	Net large, above seed.	Value of crop.	Cost of seed.	Net value of crop.
One eye	32	4	28	1⅔	26⅓	$10 08	$0 82	$9 26
Two eyes	53	5	48	3⅓	44⅔	17 28	1 63	15 65
Three eyes	65	7	58	5	53	20 88	2 25	18 63
Half tubers	112	12	100	13	87	36 00	6 37	29 63
Whole tubers	151	19	132	25	107	45 72	12 25	35 27

As to yields we quote: "The yields from these small areas on each plat all telling the same story, from the vegetation of the plants up to the harvest results, when combined, point very decidedly to one conclusion. And, when seconded by such other results as are appended, ought to carry conviction that light seeding for the potato crop is unprofitable, and that heavy seeding alone is compatible with successful work for the potato culturists.

"Just how much to plant for the greatest profit depends so much on conditions of the market at both ends of the season, the fertility of the soil and other considerations that it is obvious no definite amount can be set as the best. In the above recorded experiment, with seed and crop at the low price of 25 cents per bushel, the greatest profit was with the most seed, where the seed tubers weighed an average of five ounces each."

In this, as in the preceding table the net values are as decidedly in favor of heavy seeding. The increase is gradual up to the whole potato. The net values over seed are, $9.26, $15.65, $18,63, $29.63, $35.76.

EXPERIMENT WITH WHOLE POTATOES OF DIFFERENT SIZES.

Ninth annual report, 1890.

"On each of the tenth acre B. plats 8, 9, 10, 11 and 12, were planted three rows each of three different sizes of whole tubers carefully selected of even sizes, so the weight of the eighty-eight tubers of smallest size required for one row was eleven pounds, eighty-eight tubers of medium size required for one row was 16½ pounds, eighty-eight tubers of largest size required for one row 22 pounds. The seeding per acre and result of trial are given below:"

Table XXVIII.—*Experiments with whole potatoes of different sizes.*

Seed.	Total yield.	Small.	Large.	Amount of seed planted.	Net large above seed.	Value of large.	Cost of seed.	Net value of large.
Whole small	82	7	75	17	58	$27.00	$8.43	$18.27
Whole medium	91	7	84	25	59	30.24	12.25	17.99
Whole large	**106**	7	**99**	33	**66**	35.64	16.17	**18.47**

EXPERIMENT WITH DIFFERENT CUTTINGS OF SEED.

Conditions of experiment.

Variety, White Star.

Amounts of seed, quarters, halves and whole potatoes.

Methods of planting. The rows were 44 inches apart and the hills 18 inches apart; the experiment was thrice repeated.

Table XXIX.—*Experiment with different cuttings of seed.*

Seed.	Total yield.	Small.	Large.	Amount of seed planted.	Net large above seed.	Value of large.	Cost of seed.	Net value of large.
Quarter tubers	82	11	71	15	56	$25 56	$6 30	$19 26
Half tubers	100	16	84	23	61	30 24	11 37	18 87
Whole tubers	**126**	23	**103**	33	**70**	37 08	16 17	**20 91**

We quote conclusion as to yield: "Small as is this yield, the large amount of seed pays for itself and enough more for a margin of profit over each of the lots seeded lighter."

Now as to profits, it will be noticed by referring to the column of "net values" that the various amounts of seed did not differ greatly as to the net value of crop, but were slightly in favor of the larger amounts of seed.

MARYLAND.

Maryland bulletin No. 2, 1888.

Especial value is to be attributed to this bulletin because of the numerous experiments with many varieties under varying conditions. "There is nothing new about this trial of different methods of cutting potatoes for planting and the use of seed potatoes of different sizes, except that it is tried on new ground, and furnishes just so much additional evidence on the subject."

"The seed potatoes for this trial were got from Mr. M. F. Pierson, a noted grower at Seneca Castle, New York. He sent on 105 named varieties, which he classed as 32 early, 30 late, and 43 novelties. There were not enough tubers of each variety of the novelties to enter into the general tests, but they were used, and a special report will be made of them. The sixty-two standard varieties were grown in one group and formed the basis of this report. They were treated alike in every way throughout the season, except in the selection and cutting of the seed potatoes. In this respect five different methods were adopted for every variety. For this purpose the planting was done in five rows, three feet apart, and the hills were 2½ feet apart in the rows. There were twenty hills planted of every variety, making four hills of a kind in every row. The seed for the different rows was as follows:

"*Row A*, one large whole potato to a hill. This took the largest four potatoes of every lot. They weighed from 5 ounces to 20 ounces and averaged 10 ounces to the tuber.

"*Row B*, one whole potato, the size of a hen's egg, to every hill. In cases where the tubers were much larger than this pieces were cut from the end having the largest number of eyes, the aim being to have each of these pieces about the size and weight of the whole potatoes used in the row.

Row C, a cutting of the usual size to every hill. That is, a piece of potato about one-quarter of a fair sized tuber, the piece having from two to four eyes, and weighing about one ounce, average.

"*Row D.* A single eye to a hill, on a good-sized piece of potato. Cutting the tuber of good size to single eyes, every eye was upon its proportionate part of the whole potato.

"*Row E.* A single eye to a hill, on a very small piece of potato. The piece of potato in this case was at first about the size of that used in D, and was trimmed down to half that size or bulk.

"Thus arranged the rows had each its standard quantity or weight of seed potato to the hill, this decreasing steadily from A to E. The result shows what is, in this instance, believed to be the effect of quantity of potato tuber used for planting, upon the crop produced.

"Various causes led to a failure of certain varieties in one or more rows, or to such an extent that they had to be thrown out, in making the average result. Some grew up, but rotted, and some were on a wet spot and did not grow. Forty varieties were finally used in making up the results."

TABLE XXX.—*Average results from 40 varieties of potatoes.*

Seed.	Total yield.	Small.	Large.	Amount of seed planted.	Net large, above seed.
Single eye, on small piece	58	25	33	3	30
Single eye, on large piece	91	32	59	3	56
Fourth potato	134	51	83	6	76
Whole potato, egg size	174	67	107	18	88
Whole potato, large	269	97	172	60	112

"The difference in yield was very marked. *The exhibit plainly showed that the greater the quantity of seed potato used the greater was the product.* And this was true not only of the total yield, but also of the product of merchantable potatoes, as distinguished from those so small as to be unmerchantable. The only exception to this result in the whole four hundred average hills, occurred in eight scattered plats (single hills), none of these being on the back rows."

"The constant decrease of product in all three columns, corresponding to the decrease in quantity of seed potato planted, is too manifest to need comment."

"This experiment resembles closely in its results similar trials made under the direction of the writer in the years 1885 and 1886, at Houghton Farm, in Orange county, New York. A larger number of varieties were used there, but only three different forms of seed, corresponding to the rows B, C, and D of this year's test, (B, a whole potato as large as a hen's egg; C, a cutting of the usual size; D, a single eye with good-sized piece of potato). In 1885 there were 128 varieties used, 32 standard early kinds, 8 early novelties, 64 standard late kinds, and 24 late novelties. In 1886 the number of varieties, was 90, classed as 26 early and 64 late. The results in both years at Houghton Farm corroborate the record of the present year at this station."

TABLE XXXI.—*Average results for 3 years.*

Seed.	1885.	1886.	1888.	Average.	Seed planted.
Single eye, fair sized piece	185	110	91	129	3
Usual cutting, ¼ potato	215	224	134	191	6
Whole potato, egg size	316	354	174	281	18

The bulletin does not state whether the "yields" are total or marketable. If we subtract the amount of seed the result is practically the same since the figures are relative.

"The general result is thus emphasized: *The more seed potato planted the more and better the crop.*"

Below are the results from the 40 varieties classified as early and late:

TABLE XXXII.—*Average yields of early and late varieties, product per acre.*

Seed.	24 early varieties.			16 late varieties.		
	Total.	Small.	Large.	Total.	Small.	Large.
Single eye, small piece	61	26	35	53	23	30
Single eye, large piece	87	33	54	96	30	66
Quarter potato	136	58	78	132	42	90
Whole potato, egg size	184	79	105	160	50	110
Whole potato, large	262	109	153	280	79	203
Average	146	61	85	145	45	100

The above table shows that practically the same results were obtained from the different cuttings of seed whether the variety was an early or late one.

Third Maryland report.

Work of Verification—Potatoes. Again the effort has been made to verify the experimental results regarding the best form of potato for planting, by growing potatoes by the acre, under ordinary farm conditions, comparing the different forms of tuber for seed and with all the facts accurately observed and recorded. Although the early crop was a failure and the late one far from satisfactory, the comparative record was obtained and this again substantially verifies the conclusions of former experiments. These field tests or verifications, proved that the most profitable form of seed for potato planting, in the average season, is the whole potato of egg size, in every hill, and that in some seasons, a much larger potato uncut, is profitable."

"The arrangement of rows and distance of planting, same as in 1889. rows 2½ feet apart and hills 2 feet apart in the row. Early potatoes were planted March 26, and late potatoes June 24; in both cases, the seed was carefully dropped in the furrow, by hand, covered with a light plow, and then smoothly harrowed. On the early acre there were 48 rows, each 363 feet long, and on the late acre, 60 rows, each 200 feet long. As heretofore, the rows were planted in sets of fours alternating across the field the four forms of seed compared, viz:

" A, a whole potato about ten ounces in weight.

" B, a whole potato about the size of a hen's egg.

" C, the usual cutting, piece of medium tuber, with two to four eyes.

" D, a piece cut from medium tuber, and having one eye on it; one whole tuber or one piece, as described, in each hill.

" From these records, the product per acre has been computed from the four different forms of seed planted, and these three varieties and the results follow."

TABLE XXXIII.

Varieties and seed.	Total yield.	Small.	Large.	Amounts of seed planted.	Net large above seed.
Early Rose:					
Single eyes	41	20	21	4	17
Usual cutting, ¼ potato	62	31	31	11	20
Whole potato, small	111	55	56	24	32
" " large	169	103	66	76	*10
Early Maine:					
One eye	77	17	60	4	56
Usual cutting, ¼ potato	125	31	94	9	85
Whole potato, small	221	69	152	25	127
" " large	282	107	175	65	110
Queen of the Valley:					
One eye	92	18	74	5	69
Usual cutting, ¼ potato	111	23	88	12	76
Whole potato, small	212	79	133	26	107
" " large	283	86	197	76	121

* 10 bushels less than the seed planted.

" One of the most marked results in the record is the effect of the form of seed upon the missing hills in a crop. In a season which is very favorable for the crop throughout, this difference is less marked, but in an uncommonly dry season, or an uncommonly wet one, the whole tubers planted are very much surer to grow and give 'a good stand' than any of the forms of cut potatoes. The facts in this respect the present year have been as follows: Total missing hills, by actual count on the two acres, by half acres, according to seed planted, A, 61; B, 155; C, 391; D, 574. Estimating the whole number of hills per acre (roughly) at 9,000, the loss of 500 of these as the result of cutting to a single eye, is more than the extra cost of seed in planting whole potatoes.

" Oftentimes this matter of missing hills becomes a serious one; if a considerable percentage of the hills planted upon an acre fail to grow, the loss in the product of the acre is large, although the latter may not bear an exact ratio to the former. The records of this station show that in all seasons the larger the (whole) potatoes planted the fewer are the missing hills."

In every case, the greater the quantity of seed planted. the greater the product in bushels of merchantable tubers. The experience of the year favors on the score of economy, the practice of using whole potatoes the size of an egg, requiring from 25 to 30 bushels of seed potatoes per acre. It will be seen that in the Early Rose trial (a poor crop, however) the merchantable potatoes produced from the largest seed did not equal in quantity the seed used. And the Queen of the Valley was the only case, where the record shows that there was an actual profit in planting 76 bushels of large potatoes to the acre.

" The conclusions from the year's work on potatoes may be restated. as follows:

"1. The greater the quantity of seed planted, the greater the crop, in total product.

"2. Generally, the more seed the more good potatoes of merchantable size.

"3. The most profitable seed potatoes on the average, are those of egg size, one whole tuber being planted in every hill.

"4. The less the quantity of seed used and the more it is cut, the less the probability of getting a full stand.

"5. Cutting seed potatoes to a single eye, increases the missing hills so much, in an average season, as to materially reduce the crop."

TENNESSEE.

Tennessee bulletin Vol. III, No. 1.

"Eight different lots of whole tubers of Early Rose potatoes, were selected; each lot, with one exception, consisting of 100 tubers. Every potato in each group was weighed on a Fairbank's silk scale, in order to insure accuracy. Each lot was planted in a row by itself, the rows being three and one-half feet apart, and the tubers were two feet apart in the row, with the exception of row one, in which they were three feet apart. The ground had the best of tillage, but no fertilizers were used. Planting was done on the trench system, on April 6th, and hoeing and cultivating occurred whenever necessary."

TABLE XXXIV.

Seed.	Total yield.	Small.	Large.	Amounts of seed planted.	Net large, above seed.
1–2 ozs., 2 feet apart	128	55	73	11	62
2–3 " 2 " "	140	55	85	18	67
3–4 " 2 " "	145	67	78	26	52
4–6 " 2 " "	157	70	87	37	50
6–8 " 2 " "	167	73	94	52	42
8–10 " 2 " "	195	74	121	66	55
10–12 ozs., 2 " "	220	109	111	81	30
12–14 " 3 " "	147	69	78	64	14

"It will be noticed that, with a very slight variation, the *productiveness per hill was greatest with the largest planted tubers; and* in the case of the total crop, *decreased quite constantly with decrease of weight of seed planted.*"

"*Comparing large and medium sized whole tubers, and halves, quarters and single eyes.* Six plats, of ¼ acre each, were used in this experiment. The plats were 272 feet long, and contained 13 rows each, the rows being 3½ feet apart. No fertilizer was used, but the land was well cultivated and worked after plowing. Early Rose, northern grown, seed potatoes were used."

TABLE XXXV.

Seed.	Total yield.	Small.	Large.	Amount of seed planted.	Net large above seed.
Single eyes, medium	101	46	55	11	44
Single eyes, large	128	44	84	14	70
Quarters, medium	163	66	97	20	77
Halves, medium	156	83	73	40	33
Wholes, medium	196	81	115	58	57
Wholes, large	261	92	169	74	95

The table shows a gradual increase in yield toward the large whole with the single exception of the "half medium" which gave a very small yield. The results corroborate those of preceding experiments.

"*Comparing whole tubers with halves from wholes of the same weight.* This experiment had to objects. (a) To note the difference in yield between a certain number of tubers of the same size, planted whole, and twice that number of halves from potatoes of the same size as the wholes. (b) To note if the eyes on the under side of a whole potato, materially increase the yield over the half potato, planted with the eyes facing outward or upward.

" Five hundred and forty Early Rose potatoes, each of which weighed 67 ounces, were divided into lots of 270 each. Lot I, the wholes were planted in three rows, there being 90 tubers to the row, each baing 18 inches apart in the row, and the rows 3½ feet apart. Lot II, thus contained 540 half tubers. As arranged, lot II contained the same weight of potato, and number of eyes, as did lot 1 (twice as many rows, as will be seen by the table). Both lots lots were planted alike, and each received the same treatment. Lot II occupied six rows, and the halves were placed with the cut side under. No fertilizer was used. All of the plats vegetated and bloomed at the same time. In five out of the nine rows, a very few hills produced no potatoes. Table 36, which contains the yields, brings out the comparative difference sought for. Since the tables contain nearly 5,000 weights and numbers, as in the preceding cases, only totals and average of the whole are given."

TABLE XXXVI.—*Comparative yields of whole vs. half potatoes.*

	No. of Row.	No. of Hills.	Merchantable. Weight.		Unmerchantable. Weight.		Total crop. Weight.	
			Total.	Average per hill.	Total.	Average per hill.	Total.	Average per hill.
Lot I	1	90	48.7	8.6	62.8	11.1	110.15	19.7
	2	90	46.14	8.3	52.15	9.4	99.13	17.7
	3	84	46.4	8.8	61.4	11.6	107.8	20.4
Total weight for 270 wholes			141.9	25.7	176.11	32.1	318.4	57.8
Average per hill of 270 wholes				**8.5**		**10.7**		**19.5**
Lot II	1	89	49.8	8.8	41.13	7.5	91.5	16.4
	2	88	57.2	10.3	37.2	6.7	94.4	17.1
	3	87	58.6	10.7	29.10	5.4	88	16.1
	4	84	61.4	11.6	27.4	5.1	88.8	16.8
	5	90	55	9.7	31.14	5.6	86.14	15.4
	6	90	59.6	10.5	28.12	5.1	88.2	15.6
Total weight for 540 halves			340.10	61,6	196.7	35.4	537.1	97.4
Average per hill of 540 halves				**10.3**		**5.9**		**16.4**

" Table is interesting as demonstrating, as far as this experiment goes, the following facts. These are clearly shown in the heavy black figures in the table.

" (*a*). The *half tubers* produced a greater number and greater weight of merchantable potatoes, *per hill*, than did the whole tubers.

" (*b*). The *whole tubers* produced very nearly twice as many unmerchantable tubers, *per hill*, as did the half tubers.

" (*c*). The average weight of one hill grown from a whole tuber was

19.5 ounces, while that from half tubers was 16.4 ounces, or an increase per hill of 8.4 per cent. by using whole tubers for seed.

"(*d*). The size of the potatoes grown with half seed is somewhat larger than those trom the whole seed."

SUMMARY OF ABOVE EXPERIMENTS.

"(1). The larger the potato planted, the larger the plant produced, and the more abundant the harvest in tubers.

"(2). Other things being equal, the fewer the number of eyes in a piece of seed potato, or the smaller that piece of seed, the smaller the crop that will be produced.

"(3). The larger the quantity of whole tuber planted in a hill, the greater the cost per acre of planting and the smaller the profit on the crop.

"(4). Large and whole tubers produced smaller and poorer merchantable ones, than did half or quarter tubers, or singles eyes.

"(5). Large and whole tubers yielded appreciably more small, unmerchantable potatoes, than did parts of medium tubers or single eyes.

"(6). Given two potatoes of equal size, one planted whole will not yield so large nor so good a crop as will the other tubers cut into halves and each part planted in a separate hill.

"(7). Referring to the point III (b) on page 9, the investigation, as carried out, suggests that, in view of the fact that the whole tuber produced comparatively more small, inferior potatoes than did the halves planted, the source of these inferior tubers may be from those eyes located on the outer side of the whole potato planted. This because the eyes and shoots thus located are repressed in growth to a certain extent, owing to the pressure upon them and reversal of position.

"It is to be remembered that the above conclusions are the result of the investigations recorded and are based on nothing else. Neither in farm practice nor experimental work do we consider that they will *always* find endorsement. Yet as the result of much experimental work with seed potatoes, it is confidently believed that these conclusions will generally be fairly accurate."

EXPERIMENT WITH 74 VARIETIES.

We insert details of an experiment primarily intended as a variety test, which was reported in the same bulletin. We copy it entire because such a large number (74) of varieties were used in the test. The hills were planted much closer together than is customary in Michigan, hence the results are less favorable for the whole potatoes than they would otherwise be.

"Seventy-five varieties of potatoes were tested, the yields from whole tubers, halves, quarters and single eyes being recorded. The varieties were all planted under equal conditions, excepting in size of seed. As the samples were received from various seedsmen, some were larger than others, though as a rule the potatoes were of a medium size. The ground they were planted in was a clay loam that had received no fertilizer. Each variety was placed one foot apart in a row, and the length of the row depended upon the number of hills planted. The figures given in the following table are all average ones. That is, if, for example, 15 single-eye hills produced 150 ounces of potatoes, one hill averaged 10 ounces."

TABLE XXXVII.—*Variety yields—Average of total crop.*

Number.	Name of variety.	Source of seed.	Weight per hill in ounces.			
			Whole tuber.	Half tuber.	Quarter tuber.	Single eye.
1	American Giant	Everitt	16.6			
2	Beauty of Hebron	Henderson Landreth			21.7	8.2
3	Bliss's Triumph	Everitt	29.0			
4	Boley's Northern Spy	Wilson				18.6
5	Boston Market	Vick	20.2		11.5	9.4
6	Burbank	Johnson & Co. Landreth			26.5	17.0
7	California Peach Blow	Everitt	24.8			
8	Charles Downing	Henderson Landreth				11.1
9	Charter Oak	Henderson				13.7
10	Chicago Market	Vick	20.0		18.6	14.4
11	Clark's No. 1	Henderson Thorburn	54.0		19.0	8.0
12	Crown Queen	Everitt	16.9			
13	Dakota Red	Thorburn Everitt	4.0		32.2	24.6
14	Dakota Seedling	Everitt	5.9			
15	Dictator	Thorburn			30.0	22.4
16	Early Albino	Thorburn			6.5	7.4
17	Early Gem	Vick	19.1		13.2	6.8
18	Early Goodrich	Johnson & Co.			13.0	4.8
19	Early Market	Vick	19.4		11.2	7.3
20	Early Ohio	Henderson Vick	20.4	17.0	13.0	3.8
21	Early Rose	Henderson Johnson				8.6
22	Early Sunrise	Henderson Thorburn Bouk	43.0		10.5	5.7
23	Early Puritan	Henderson Thorburn	45.7		19.2	3.9
24	Early Vermont	Landreth	29.7		8.0	5.6
25	Empire State	Henderson				17.9
26	Garfield	Landreth	43.7		9.0	
27	Everitt	Everitt	28.1			
28	Gen. McLean	Wilson			25.5	12.8
29	Great Eastern	Thorburn			28.5	16.0
30	Green Mountain	Vick Wilson Everitt	11.8	23.5	13.7	20.0
31	Illinois	Everitt	16.0			
32	June Early	Wilson Everitt	35.3			9.2
33	Late Beauty of Hebron	Thorburn			7.0	19.0
34	Maine Rose	Wilson				17.9
35	Mammoth Pearl	Landreth	57.0		19.5	7.0
36	Mammoth White Chief	Bouk				3.6
37	Mayflower	Landreth			15.2	9.7
38	McFadden's Favorite	Bouk				12.8
39	Morning Star	Landreth			45.2	21.8
40	New Queen	Everitt Bouk	25.8			10.2
41	North Georgia (Native)	Johnson & Co.	41.0	17.5	20.5	19.9
42	No. 50 Seedling	Vick	45.0	24.0	18.0	14.3
43	Ohio Junior	Vick	24.2	19.5	13.2	4.7
44	O. K. Mammoth Prolific	Thorburn			34.7	20.3
45	Peach Blow Seedling	Bouk				4.6
46	Pearl of Savoy	Henderson Thorburn			4.0	13.0
47	Peerless	Johnson & Co.	43.0		27.5	13.2
48	Perfect Peach Blow	Henderson Vick	7.8		9.5	21.3
49	Poland	Everitt	22.3			
50	Potentate	Everitt	22.5			
51	Prairie Queen	Bouk				4.7
52	Pride of Nebraska	Bouk				5.2
53	Pride of the Field	Wilson				16.1
54	Prince Ed. Island Rose	Landreth	34.0	10.2	11.7	6.3
55	Rose's Beauty of Beauties	Bouk				2.5
56	Rose's Beauty of Hebron	Thorburn Vick	22.0		33.0	21.0
57	Rose's New Giant	Thorburn			28.5	17.3

TABLE XXXVII.—*Continued.—Variety yields—Average of total crops.*

Number.	Name of variety.	Source of seed.	Weight per hill in ounces.			
			Whole tuber.	Half tuber.	Quarter tuber.	Single eye.
58	Rose's Seedling	Wilson				20.1
59	Rural Blush	Henderson Thorburn			14.5	16.0
60	Rural New Yorker No. 2	Henderson Thorburn			17.5	14.9
61	Snowflake	Johnson & Co.	72.0	28.5	19.7	13.2
62	Snow Queen	Thorburn			15.5	8.0
63	State of Maine	Landreth Wilson	50.5		24.5	21.6
64	Stray Beauty	Wilson				5.4
65	Sunlit Star	Wilson			19.2	11.5
66	Triumph	Henderson				5.5
67	Thorburn	Thorburn			10.5	7.4
68	Thorburn's Late Rose	Wilson			32.0	25.4
69	Vanguard	Henderson				5.5
70	Vick's Prize	Vick	17.4	45.5	11.0	8.0
71	Watson's Seedling	Wilson				18.8
72	White Elephant	Thorburn Johnson & Co.	47.0		37.1	15.8
73	White Star	Henderson Johnson Vick	18.5	27.2	14.0	7.7
74	White Superior	Vick	20.6		16.0	15.0
	Average yield per hill		29.0	23.6	18.8	12.2

"I would especially direct the reader's attention to the relationship of size of seed tuber to crop production. While in each class of plantings the yield is variable often to a considerable extent, an average of all the hills in each class of seed planted of 74 varieties, shows a continual decrease in yield and number of tubers per hill, from the whole potato down to the single-eye. In brief, *the experiments at this station on the relation of size of seed tubers to crop yield, demonstrate that the larger the piece of seed potato planted, the greater will be the yield.* This, it may be said, is also the result very generally arrived at at other stations that have done similar work."

INDIANA.

Bulletin 42, Vol. III, Nov., 1892.

We quote from the above named bulletin the result of some experiments by Prof. J. C. Arthur.

Conditions of experiment.

Variety, Burbank and Beauty of Hebron.

Time of planting, May 23.

Amount of seed, Burbank, ranging from one to five ounces apiece. Beauty of Hebron, ranging from two to five ounces apiece.

Method of planting, hills three feet apart each way.

"It has been demonstrated that the number of stalks produced increased with the increase in weight of the seed piece, and that in practice the weight of the piece is the controlling factor, even when the common method of cutting to eyes is followed. In order to complete the argument it is necessary to show what relation exists between the number of stalks and the yield. The facts in this connection may be gathered from the following table:

TABLE XXXVIII.—*Number of stalks per hill compared with the yield.*

Varieties.	Size of tubers planted.	Av. No. stalks per hill.	Yield per acre in bushels.		
			All sizes.	Small.	Large.
Burbank	1 oz.	4.3	38	16	22
"	1½ "	4.9	67	23	44
"	2 "	6.5	83	28	55
"	2½ "	6.7	92	36	56
"	3 "	7.9	113	38	75
"	3½ "	8.4	120	34	86
"	4 "	9.5	163	49	114
"	4½ "	9.6	172	50	122
"	5 "	10.0	175	55	120
Beauty of Hebron	2 "	4.9	157	37	120
" " "	2½ "	5.7	169	41	128
" " "	3 "	6.3	181	50	131
" " "	3½ "	7.0	191	52	139
" " "	4 "	7.6	216	58	158
" " "	4½ "	8.5	228	65	163
" " "	5 "	8.9	225	68	157

"Both varieties teach exactly the same lesson. There is a uniform increase in the average number of stalks per hill to correspond with the increased size of the seed tuber used. With the increase of the number of stalks per hill there is also a practically uniform increase in the weight of the product, whether considered as total yield or separated into small and large tubers.

"The increase in yield is absolute up to a limit that is likely to include all requirements of the cultivator. But it will be noticed that while seed tubers weighing up to 4½ ounces give increasing yield to correspond with the weight of the seed material used, above that point there is a falling off in yield of merchantable product. This is doubtless due to the crowding of the hills with stalks, which prevents the proper development of the individual tubers."

SUMMARY.

"The question of the right number of eyes to the piece of seed tuber has long engaged the attention of cultivators and experimenters without receiving a generally acceptable answer. The experimental data here brought forward proved that the number of eyes per piece is immaterial, but that the weight of the piece is a very important factor. The proper manner of cutting potatoes for planting, therefore, is to divide them into pieces of suitable weight (size), without regard to the distribution of the eyes. Instead of attempting to have one, two or three eye pieces, as the case may be, the approximation should be to one, two or three ounce pieces, or some other definite weight."

Since the above experiments show that the yield is more in proportion to the *weight* of the seed planted than to the number of eyes, the common practice among farmers of cutting out the eyes is to be strongly condemned.

KENTUCKY.

Bulletin No. 16 (for '88).

"The Early Rose potato was the variety used. The 'seed' was obtained from Ohio. Each plat received exactly the same treatment as to preparation and cultivation In all plats the potatoes were planted 14 inches apart in rows 3 feet wide, except that in plat No. 6 they were put 24 inches apart in the row.

"The plats were 1-10 acre each in size.

"Plat No. 1 was planted with the average run of potatoes as they came from the barrel, cut to two eyes.

"Plat No. 2 was planted with large, selected potatoes planted whole.

"Plat No. 3, very small potatoes planted entire.

"Plat No. 4, selected large potatoes, cut to two eyes.

"Plat No. 5, small potatoes, cut in pieces containing two eyes each.

"Plat No. 6, seed same as No. 1, potatoes planted in hills two feet apart.

"The following table shows the yield calculated per acre:

Table XXXIX.

Seed.	Total yield.	Small.	Large.	Amounts of seed planted.	Net large above seed.
Two eyes, from small potato	41	21	20	5	15
Two eyes, from medium potato	43	16	27	7	20
Two eyes, from large potato	45	20	25	7	18
Whole, small	62	32	30	11	19
Whole, large	77	26	51	47	4

"These results add to the evidence obtained heretofore at this station, and to the many results obtained elsewhere, that by using whole potatoes of large size for seed in place ot small potatoes or 'cut seed,' *there follows an increased yield in crop.*

"But the results this year do not warrant the statement *that it pays to plant large whole potatoes.*

"The season and soil were unfavorable to such a test. *When the season is favorable and the soil is rich, the evidence from many experiments tends to show that the value of the increased yield produced by planting large sized potatoes more than compensates for the increased outlay for seed.*

"Experiments made at this station in a rich soil and in a fair season in the year 1886, gave the following results per acre:

TABLE XL.

Seed.	Total yield.	Small.	Large.	Amounts of seed planted.	Net large above seed.
Two eyes	150	30	120	7	113
Whole, small	193	48	145	7⅓	137⅔
" large	260	50	210	47	163

We quote from *Bulletin No. 22, 1889:*

"Five plats were used in these experiments. They were each one-eightieth of an acre in size." Northern grown Early Rose was the variety used. In all the plats the potatoes were planted 14 inches apart and in rows 3 feet wide."

"The following table shows the yield calculated per acre:

TABLE XLI.

Seed.	Total yield.	Small.	Large.	Amounts of seed planted.	Net large above seed.
Two eyes, medium	187	59	128	6	122
" " large	184	51	133	8	125
Half, large	278	-------	-------	24	-------
Whole, small	272	99	173	17	156
" large	344	131	213	48	165

"These results show that by planting large whole potatoes there was an increased yield over the usual method of planting of nearly 100 bushels per acre of merchantable potatoes. This has been our third trial and each time the result has been the same, that is, by planting large whole potatoes, instead of cut potatoes, there follows an increased yield in the crop.

"This is substantiated by compared results obtained by many similar experiments throughout the country. It seems, therefore, that the yield is in direct ratio to the weight of seed planted. Whether it will pay to plant large whole potatoes rather than small or cut potatoes, depends largely upon the season and the price of seed potatoes, as well as the price of the harvested crop."

LOUISIANA.

Louisiana Station, Bulletin No. 4, 2d series.

At the Louisiana Experiment Station during the season of 1888 tests were made to determine the "size of potato best adapted for seed." We quote the conditions of the experiment, together with remarks, and tabulate the results, from Bulletin No. 4, second series.

"Seven varities of potatoes were used, each being treated exactly alike.

"In each row there were eight large potatoes; eight medium potatoes;

eight potatoes cut to two or more eyes; and eight pieces cut to one eye; unweighed and planted one foot apart.

"The productive results concur with those of previous years; the larger the seed planted, the greater the yield. The economical results are, however, different. To determine these an account must be taken of the seed planted and the net yield per acre determined. In this calculation a farmer's acre of 70 yards square is assumed for convenience. The rows were three feet apart and the potatoes dropped one foot apart. This gives 1,456 hills per acre."

TABLE XLII.—*Results from different varieties and different amounts of seed.*

Varieties and amounts of seed.	Total yield.	Small.	Large.	Amounts of seed planted.	Net large, above seed.
Early Rose:					
One eye	260	12	248	5.5	242.5
Two or more eyes, cut	262	21	241	14	227
Whole, medium	306	21	285	41	244
Whole, large	376	49	327	97.5	229.5
Boston Peerless:					
One eye	213	10	203	4	199
Two or more eyes, cut	355	20	335	20	315
Whole, medium	311	12	299	45	254
Whole, large	393	49	344	130	214
Beauty of Hebron:					
One eye	211	4	207	8	199
Two or more eyes, cut	268	20	248	14	234
Whole, medium	288	20	268	32.5	235.5
Whole, large	305	20	285	87	198
Rural Blush:					
One eye	159	10	149	12	137
Two or more eyes, cut	169	20	149	14	135
Whole, medium	233	30	203	41	162
Whole, large	374	30	344	97.5	246.5
Extra Early Vermont:					
One eye	177	20	157	4	153
Two or more eyes, cut	203	20	183	20	163
Whole, medium	177	20	157	33.5	123.5
Whole, large	209	10	199	74.5	124.5
Russette:					
One eye	162	20	142	4	138
Two or more eyes, cut	258	10	248	16	232
Whole, medium	274	30	244	* 14	230
Whole, large	278	30	248	80	168
Burbank:					
One eye	135	20	115	4	111
Two or more eyes, cut	213	10	203	6	197
Whole, medium	193	10	183	32.5	150.5
Whole, large	254	20	234	43	191
Average for 7 varieties:					
One eye	188	13.7	174	6	168
Two or more eyes, cut	249	17	230	15	215
Whole, medium	256	20.4	231	34.5	199.5
Whole, large	312.7	29.7	283	87	196

*—?

"From the above it would seem that while total production is in direct proportion to the size of seed planted, the net yield, after deducting seed planted, varies but little. It is doubtful whether on a large scale pieces of potatoes larger than four eyes or smaller than two eyes, will be found of the most profitable use as seed."

GEORGIA.

From bulletin No. 17 of the Georgia station we quote the following tables:

TABLE XLIII.—EARLY ROSE.—*Different quantities of seed planted at different distances.*

Seed.	Distance apart in rows.	Total yield.	Small.	Large.	Amounts of seed planted.	Net large, above seed.
Single eyes	6 in.	55	8	47	12	45
" "	12 "	45	7	38	6	32
Two eyes	6 "	66	10	58	28	28
" "	12 "	61	10	51	14	37
Quarter medium tuber	12 "	73	12	61	18	43
" " "	18 "	71	12	59	12	**47**
Half " "	12 "	**85**	19	**66**	36	30
" " "	24 "	70	17	53	18	35

TABLE XLIV.—BEAUTY OF HEBRON.—*Different quantity of seed planted at different distances.*

Seed.	Distance planted. Inches.	Total yield.	Small.	Large.	Amounts of seed planted.	Net large above seed.
Single eyes	6	49	7	42	12	40
" "	12	47	9	38	6	32
Two eyes	6	63	9	54	28	26
" "	12	55	8	47	14	33
Quarter medium tuber	12	70	10	60	18	42
" " "	18	72	12	60	12	**48**
Half medium tuber	12	**82**	18	**64**	36	28
" " "	24	64	18	46	18	28

"A careful study of the table," we quote, "indicates that the yield increases with the size of seed, and that in all cases but one the increase in distance results in a decrease in yield."

From the same bulletin we quote the tabulated results of another experiment with the remarks thereon.

"The question, Does the smaller or greater amount of flesh in the seed pieces condition the vigor of the plant and consequently the yield of the potatoes? Or, in other words, does the amount of nutriment in the seed piece influence the result of the crop? As also, are seed pieces from large tubers more profitable than those from small tubers? was the object of an experiment as illustrated in table No. 3."

TABLE XLV.—*Early Rose.*

Seed.	Total yield.	Small.	Large.
Two eyes, small potato	52	9	43
" " (same weight), large potato	60	13	47
" " (regularly cut), " "	61	14	47
Large potato (all eyes cut out but two)	85	15	70
Small " size of walnut	47	14	33

TABLE XLVI.—*Beauty of Hebron.*

Seed.	Total yield.	Small.	Large.
Two eyes, small potato	45	9	36
" " (same weight) large potato	54	11	43
" " (regular cut) " "	56	9	47
Large potato, all eyes cut out but two	82	17	65
Small " size of walnut	44	16	28

In the remarks they state: "The largest yield was obtained from the large whole potatoes, the smallest from the small tubers. It would seem that the larger amount of food contained in the whole tubers induced a more vigorous growth at the start, causing a greater development of the root system, making the plant better adapted to assimilate the plant food in the soil.

"If we compare the result between two eyes from the small and large tubers, both of the same weight, we find the balance in favor of seed from large tubers, while the difference between seed pieces from large tubers but different amounts of flesh, is only slightly in favor of the larger pieces."

WISCONSIN.

Bulletin No. 22, Wis. Sta., Jan., 1890.

" The results of our test with the different amounts of seed appear from the brief tables in which the figures represent the average yield of ten duplicate rows, 50 feet long, planted with each kind of seeding. The variety was purchased for Beauty of Hebron, but proved to be considerably mixed. The seed was planted, one tuber or cutting in a place, April 30, in hills 38 inches apart both ways. The soil and cultivation were the same as described for the variety test.

TABLE XLVII.—*Results of ten duplicate rows.*

Seed.	Total yield.	Small.	Large.
One eye	133	18	115
Two eyes	172	31	141
Half potato	193	68	125
Whole potato	231	91	140

TABLE XLVIII.—*Whole potatoes of different sizes.*

Seed.	Total yield.	Small.	Large.
Whole, small	118	19	99
" medium	183	62	121
" large	15	80	135

"As appears, the total yield was directly in proportion to the bulk of seed planted. But in merchantable yield, the two-eye cuttings slightly surpassed the halves and whole tubers.

"As appears from the preceding table, the whole potatoes yielded more merchantable tubers than the halves, and in another experiment made under precisely the same conditions, not reported in this bulletin, two large whole potatoes to the hill yielded more merchantable tubers than did one. The smaller merchantable yield of the halves and whole potatoes could not, therefore, have been due to an excessive amount of seed. It is far more probable that it was due to the dearth of moisture, which prevented the large setting of tubers in these rows, induced by the abundant nutriment furnished in the seed, from attaining merchantable size, and that with an average rainfall, the heavier seedings would have given the larger merchantable yields. This was the case where the whole tubers of different sizes were compared, as appear from the lower part of the table."

MASSACHUSETTS.

Below is a summary of the results of two year's experiments at the Massachusetts Station, condensed from the second and third reports. The results given the table are the averages for three experiments for each of the two years. In two experiments, fertilizers were used; in the third the plat was left unfertilized. In all three nearly the same relative results were apparent. The variety used both years was Beauty of Hebron, and the plats were one-fifth acre each in extent. The potatoes were planted in drills about three feet apart, and fourteen to twenty-four inches in the row.

TABLE XLIX.—*Average results from three experiments for two years.*

Seed.	Total yield.	Small.	Large.
Half potato	86	25	61
Whole potato	98	32	66

From the sixth annual report we quote the conclusions arrived at from the experiments resulting as above:

"Medium sized whole potatoes give better results, as far as large sized, marketable crop is concerned, than half potatoes obtained from tubers of a coresponding size,"*

OHIO.

In the sixth annual report of the Ohio station, the results of experiments extending over a period of four seasons are summarized. "Large, fine potatoes were used in all cases whether cut or planted whole." We tabulate the results below:

TABLE L.—*Results at the Ohio station.*

Year of experiment and amounts of seed.	Total yield.	Small.	Large.
1883:			
One eye	135	10	125
Whole potato	264	22	242
1884:			
One eye	91	4	87
Whole potato	172	14	158
1885:			
One eye	174	22	152
Two eyes	262	44	218
Half potato	338	112	226
Whole potato	346	113	233
1886:			
One eye	56	35	21
Two eyes	99	57	42
Half potato	114	68	46
Whole potato	165	113	52
Average for two years, 1885–86:			
One eye	115	29	86
Two eyes	180	51	129
Half potato	226	90	136
Whole potato	255	113	142

"It will be seen that the total yield has been uniformly in favor of the large cuttings, but it is also true that the greater the number of eyes in a piece, the larger the per cent of small potatoes. The per cent of small potatoes is, however, much dependent upon circumstances, such as condition of soil and amounts of rain fall." "Despite the fact that whole potatoes give more small potatoes than one and two eye cuttings, it is also true that they give more large potatoes."

UTAH.

Bulletin No. 5, Utah Station, March, 1891.

"The ground on which the potatoes were planted is a sandy loam and newly broken. Owing to slight inequalities in the soil the results are only approximate.

"Planting commenced on May 8, and all the plants in any one experiment were planted the same day.

"The plats contained 1–20 of an acre each. The rows were all three feet apart and the potatoes were one foot apart in the row."

TABLE LI.

Seed.	Total yield.	Small.	Large.	Amounts of seed planted.	Net large above seed.
Two eyes	109	37	72	12	60
Quarters	133	51	82	14	68
Half potato	157	64	93	27	66
Whole potato	162	84	78	55	23

"It will be seen that the yield increased as the size of the pieces planted increased, not, however, in exact ratio. It will also be noticed that the rate of increase of large potatoes was less than that of the small ones. Especially is this noticeable in the change from half potato to whole potato seed; in this instance there is an actual decrease in the amount of large potatoes of 16 per cent, while the increase of small potatoes is 31 per cent, and the total increase is only three per cent.

"The increase of the plat planted to potatoes cut in quarters over the plat planted to two eye pieces is, large potatoes 12 per cent; small potatoes 26 per cent, total increase 18 per cent."

Note by J. W. Sanborn, same bulletin. –"To the above data furnished by Prof. Richmond, I will add the average of seven year's experiment work on college farms of two states of the east. These results are in accord with unrecorded results of a trial on the private farm of the writer, and with many recorded results of investigators who have conducted trials at several experiment stations.

"There seems to be little occasion to doubt that light seeding for the potato crop is followed by a far smaller crop than the use of large seed would give."

TABLE LII.

Seed.	Yield.
One eye	81
Two eyes	104
Three eyes	160
Whole, small	177
Whole, large	224

"Later trials with seed cut lengthwise of the potato, showed that the system was the most economical of any tried. Good sized potatoes may be cut lengthwise into two pieces, and very large potatoes into three or four pieces. Neither one nor two eyes, not the seed, nor the stem end of potatoes should be used."

NEVADA.

Bulletin No. 14, Nevada Station, 1891.

"Four rows, each 132 feet long, of the White Flower were planted May 9, using seed cut to one and two eyes, also half and whole potatoes."

TABLE LIII.

Seed.	Total yield.	Small.	Large.
One eye	146	26	120
Two eyes	165	34	131
Half potato	145	55	90
Whole potato	191	11.6	75

"It will be noticed that the amount of small potatoes becomes greater as the seed is increased from one eye.

"The per cent of small potatoes is least with one eye and greatest where the whole potatoes were used, although the latter gives the best results for total weight."

TABULATED SUMMARY.

Table LIV. is a compilation of the results obtained in Michigan and New York.

Table LV. shows the number of instances in which the two eyes or half potato gave the better results in Michigan and in all other states.

Table LVI. shows the number of instances in which the whole potato and half potato gave the better results.

TABLE LIV.—*Averages for Michigan and New York.*

	McElroy table.	Hale table.	Hale table.	McGee table.	McGee table.	Prof. Taft Av. 3 yrs. table.	N. Y., Geneva, table.	N. Y., Geneva, table.	N. Y., Geneva, table.	Ohio table.*	Av. for Mich.	Av. for N. Y.	Av. of Michigan and New York.
Total—													
One eye	88	72	229	130	239	....	55	32	....	115	151	43.5	120.7
Two eyes	181	85	272	173	242	....	93	58	82	180	190	76	147.62
Half potato	203	107	259	227	325	....	173	112	100	226	224	128.3	188.25
Whole potato	212	173	264	273	375	....	212	151	126	255	259	163	223.25
Large—													
One eye	78	61	221	89	188	100	51	28	....	86	123	39.5	102
Two eyes	160	82	264	129	158	121	87	48	71	129	152	68.6	124.41
Half potato	173	88	248	159	219	169	154	100	84	136	176	113.6	166
Whole potato	183	138	240	182	263	178	189	132	103	142	197	141.3	178.66
Net large—													
One eye	75	55.6	216	84	183	96.7	49.30	26.33	....	83	118	37.81	98.20
Two eyes	154	71	253	118	147	113.5	83.66	44.66	56	124	143	61.44	115.60
Half potato	161	64	224	125	195	140.4	138	87	61	124	153	95.3	134
Whole potato	159	90	192	134	215	119.1	157	107	70	118	152	111.3	138
Net value—													
One eye	$31.97	$24.14	$94.54	$36.46	$80.20	$41.85	$17.54	$9.26	....	$36.34	$51.70	$13.40	$42.12
Two eyes	67.40	30.68	110.76	57.36	64.12	49.49	29.69	15.65	$19.26	58.66	63.30	21.53	49.38
Half potato	70.12	26.72	97.12	57.96	84.36	60.06	47.60	29.63	18.87	53.84	66.06	32.03	54.71
Whole potato	68.52	36.72	81.60	56.08	91.72	48.87	52.36	35.27	20.91	50.48	63.91	36.18	54.65

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* We give the net value of the Ohio experiment at Michigan prices, being unable to obtain Ohio prices, for which reason we omit the column in the grand average.

TABLE LV.—*Half potato vs. two eyes.*

		No. of times the two eyes and half potato gave the better results.		Totals.
		Michigan	All other states.	
Total yield	Two eyes	7	12	19
	Half potato	29	47	76
	Totals	36	59	95
Marketable	Two eyes	6	9	15
	Half potato	25	33	58
	Totals	31	42	73
Net marketable	Two eyes	2	5	7
	Half potato	10	13	23
	Totals	12	18	30
Net value of crop	Two eyes	2	6	8
	Half potato	10	12	22
	Totals	12	18	30

TABLE LVI.—*Half potato vs. whole potato.*

		No. of times the half and whole potato gave the better results.		Totals.
		Mich.	All other states.	
Total yield	Half potato	4	4	8
	Whole potato	26	20	46
	Totals	30	24	54
Marketable	Half potato	4	2	6
	Whole potato	26	10	36
	Totals	30	12	42
Net marketable	Half potato	4	2	6
	Whole potato	2	5	7
	Totals	6	7	13
Net value of crop	Half potato	4	1	5
	Whole potato	2	5	7
	Totals	6	6	12

APPENDIX.

Indiana Bulletin No. 38, Vol. III, Mar. 1892.

EXPERIMENT IN METHODS OF CUTTING AND CULTIVATION OF POTATOES.

"The ground for this experiment was first prepared by plowing under ten tons of stable manure in the fall of 1890." (Commercial fertilizers were also applied thoroughly to the soil, particulars of which are given in the Bulletin.)

"On October 2, they were all dug and carefully weighed, with the following results:

	Bushels.
Plat 1 a (whole tuber mulched)	108
Plat 1 b (whole tuber tips removed)	135
Plat 1 c (½ tuber, tips removed)	158
Plat 2 a (whole tuber not mulched)	213
Plat 2 b (tips removed, not mulched)	216
Plat 2 c (½ tuber, not mulched)	245
Plat 3 a (whole tuber, not mulched)	198
Plat 3 b (tips removed, not mulched)	216
Plat 3 c (½ tuber, not mulched)	205
Plat 4 (seed-ends)	145

"*Conclusions.* Half tubers produced a larger yield than whole ones. Seed ends gave a much larger proportion of large tubers."

New York State Station (Geneva), Seventh Annual Report.

"CUTTINGS VS. WHOLE TUBERS OF THE SAME WEIGHT.

"*Object of the experiment:* To ascertain if anything is gained by cutting tubers for seed.

"An experiment was made in 1886 and repeated in 1887 with whole tubers of various sizes as compared with cuttings, of which the average weight was the same as that of the whole tubers. The results not appearing conclusive, this experiment was repeated the past season on a larger scale, the area devoted to it comprising twelve main plats of one-tenth acre each."

"In preparing the seed, the number of cuttings required for one row was first made and their weight noted. The same number of whole tubers of nearly uniform size was then picked out and weighed. If their weight exceeded that of the cuttings the larger ones were replaced with smaller until their weights were equal, and *vice versa.*

“The plats were planted May 2, the tubers or cuttings being placed 12 inches apart in the drills, and the crop was harvested Oct. 10 and 11, at which time the tops were, with the exception of an occasional stalk, entirely dead.

“In the following table the aggregate merchantable and total yields of the four rows planted with the cuttings and with the whole tubers in each plat are given separately, and also the differences in favor of each. The size of the cuttings planted in the different plats is noted at the right.”

TABLE LVII.—*Cuttings versus whole tubers of the same weight.*

	Cuttings.		Whole tubers.		Difference in favor of			
					Cuttings.		Whole tubers.	
	Merchantable.	Total.	Merchantable.	Total.	Merchantable.	Total.	Merchantable.	Total.
Single eyes *vs.* whole tubers	180¼	211¼	135¾	191½	44½	19¾	--------	--------
Two eye cuttings *vs.* whole tubers	162¼	188½	167	196¾	--------	--------	4¾	8¼
“ “ “ “ “ “	223¾	243¼	214	244¾	9¾	--------	--------	1½
Three eye “ “ “ “	207½	230¼	205¾	233¾	1¾	--------	--------	3½
“ “ “ “ “ “	302½	330¼	277¾	312½	24¾	17¾	--------	--------
“ “ “ “ “ “	277¼	312	286	323	--------	--------	8¾	11
Half tubers *vs.* whole tubers	373¼	435¼	347	404¾	26¼	30½	--------	--------
“ “ “ “ “	333¼	381¼	318¼	369½	15	11¾	--------	--------
“ “ “ “ “	405¼	447¾	367¼	418	38	29¾	--------	--------
“ “ “ “ “	345¾	386¼	370½	414½	--------	--------	24¾	28¼
“ “ “ “ “	296½	344	323¾	374¾	--------	--------	27¼	30¾
“ “ “ “ “	239	283¼	255	309½	--------	--------	16	26¼
Total difference					160	109½	81½	109½
Net difference					78½	--------	--------	--------

“It is possible that the number and magnitude of the experiments are not sufficiently large to justify a final conclusion, but so far as their teachings go, we may infer that, under conditions like those of the station, little or nothing is gained by using cut potatoes for seed, while the labor of cutting and the greater market value of the larger tubers may constitute a positive loss.”

REMOVING THE SEED ENDS.

“It has been asserted that the maturity of potatoes may be hastened by cutting off the end of the seed tuber opposite to the stem.

“An experiment made upon some of our experimental plats did not confirm this proposition. The plats were planted May 16, with tubers of medium size, those planted in alternate rows having the ‘seed’ ends removed, and the remainder having an equal amount cut from the opposite end, the tubers being placed 2 feet apart. No difference was perceptible in the time of dying of the tops. The yield showed an excess in favor of retaining the 'seed' end of 28 pounds on the 1-20 of an acre, which in this case was nearly 20 per cent. of the whole crop.

"The pieces cut off were also planted with very similar results, that is to say, that there was no perceptible difference in the time of maturity, and the 'seed' ends yielded somewhat more than the stem ends.

"The results of these trials agree with those secured in a previous experiment in the use of the seed and stem end of tubers for planting."

New York (Geneva), Station Report, 1889.

"LARGE VS. SMALL TUBERS FOR SEED AND THE SAME WITH THE 'SEED' ENDS REMOVED."

"Eight of the ten rows were used for a small trial under this head. The whole tubers averaged 4.6 ounces each, but when the 'seed' ends were removed the weight was reduced to a little under 4 ounces. The small tubers averaged 2.2 ounces, and when the 'seed' ends were removed under 2 ounces. These were planted thus: Large tubers whole, then the same with the seed ends removed, followed by small tubers, and small tubers with seed ends removed.

"There were no missing hills at harvest, hence the amounts given in the table were actually harvested.

TABLE LVIII.—*Large vs. small tubers for seed and the same with the "seed" ends removed.*

	Seed used per row. lbs	Merchantable tubers. lbs	Merchantable size, but decayed. lbs	Small tubers. lbs	Total tubers. lbs	Difference in favor of							
						Large seed.				Small seed.			
Large tubers	9½	48.13	8.41	2.88	59.42	40.14	14.31	2.46	56.91	----	----	----	----
	9½	42.44	11.00	1.81	55.25								
Same with seed ends removed	8	44.69	7.80	1.94	54.43	------	------	------	------	----	----	----	----
	8	43.48	6.13	2.13	51.74	------	------	------	------	----	----	----	----
						Difference in favor of whole tubers.				Tubers with seed ends removed.			
Small tubers	4½	35.75	5.31	3.94	45.00	2.40	5.48	.62	8.50	----	----	----	----
	4½	39.48	3.95	.28	43.71								
Small tubers with seed ends removed	4	29.09	1.19	1.08	31.36	------	------	----	----	----	----	----	----
	4	34.28	8.58	1.00	43.86	11.86	------	2.14	13.49	----	.51	----	----

'On comparing the four rows with large seed with the four where small tubers were used for seed, the differences in favor of the heavier seeding amounts to over 33 bushels per acre for 15 bushels of seed and the extra labor of putting in the seed and harvesting one load more of crop. If seed and crop were both fifty cents per bushel, this increased pay for labor would amount to nine dollars, with the possibility of fifteen dollars, should there be no decayed tubers per acre.

"Comparing the yields between whole and cut tubers, four extra bushels of seed in whole tubers produced about ten bushels more merchantable crop, which, at the same prices, would pay for seed and leave three dollars for handling the extra crop without the labor of cutting the seed."

Utah, Bulletin No. 5.

Object of Experiment.—To observe the effect on yield and health of potatoes, of planting large or small seed for a series of years.

"Platt 11 was planted with large potatoes cut in four pieces."

TABLE LIX.—*Large vs. small seeds.*

Seed.	Total yield.	Small.	Large.
Small potatoes	131	44	87
Large potatoes	136	53	83

"While the yield is a little greater when planted with large potatoes, being 16 lbs., more or four per cent, it is hardly enough to say it is caused by the larger seed, especially when the small seed gave 12 lbs., more of large potatoes."

We give the average results of several trials made by Prof. Sanborn with the seed and stem ends. "Average yield from stem end, 148 bushels for a period of seven years. Average yield from 'seed-ends' 168 bushels for a period of six years."

P. M. HARWOOD, *Agriculturist.*
P. G. HOLDEN, *Assistant.*

AGRICULTURAL COLLEGE,
April, 1893.

BIRDS OF MICHIGAN.

No. 94.—Zoölogical Department.

INTRODUCTION.

Of the several lists of the birds of Michigan, from that of Dr. Abram Sager, published in 1839, to the most recent by Dr. Morris Gibbs, published in the Ornithologist and Oölogist. Vol. 10, 1885, not one is accessible to the younger students of ornithology. While some of the lists are quite full and accurate, not one gives the food and nesting habits of our birds. Such a list can but fill a pressing need, and must receive a most hearty welcome. Indeed I have had frequent inquiries for a catalogue, by my students and others, and often have been urged to prepare a list.

Owing to my very numerous duties at the college, and my greater interest in the study of entomology I have, previous to this time, been unable to give any time to this work. The past summer the valuable manuscripts of the late Dr. H. A. Atkins came into my hands, and the State Board of Agriculture voted that I should prepare a list, to be sent out as a bulletin by the experiment station.

Having taught ornithology for the past twenty-six years at the Michigan Agricultural College to large classes, in which there were many good observers who had already made some progress in this study, and who represented many sections of the State, and having in the meantime made quite a considerable collection, through the aid of my students, of birds and birds' eggs for our museum, of which I have had the entire charge, I have been able to gather many and some valuable facts regarding the birds of our State.

I have also had in my possession all the manuscripts of the late Dr. H. A. Atkins, of Locke, Michigan, who was for twenty-nine years a most enthusiastic and conscientious student of this branch of natural history. Dr. Atkins kept a careful record of the birds of Locke, Ingham county, Michigan, with the date of the capture of each species, the time of the first appearance and exit, each year, and the full dates of all migrations. This record was very full and accurate, considering the meager literature that Dr. Atkins had at his command. Dr. Atkins visited me quite frequently, and I am assured of his entire devotion to this science, and his earnest effort to secure all possible accuracy in his determination of species and his statements of facts. I have received valuable aid from Dr. Atkins' carefully prepared manuscript, and have starred every bird that he reported from our State. For the dates, nesting habits, number and color of eggs, I am much indebted to these manuscripts which, through the kindness of Mrs. Atkins were put into my possession. Nearly all the birds reported by Dr. Atkins have also been taken here, and so have come under my own personal observation. Dr. Atkins' observations were nearly all made at Locke, and the species starred were all taken at that place, unless special mention is made to the contrary.

I have also received great assistance from Mr. A. W. Butler, of Brookville, Indiana. I have not only profited from his excellent "Birds of Indiana" (one of our most complete and most admirably arranged list of birds), but he has kindly reviewed my list and offered most valuable suggestions, has loaned me books and papers, and has given me very valuable assistance in the preparation of the bibliography.

I have profited much from the accurate lists of Michigan birds prepared by Dr. Morris Gibbs of Kalamazoo, Michigan, from his many valuable articles in the several ornithological papers, and additions, corrections and suggestions given me in the preparation of this list. Dr. Gibbs has also helped me very much in the preparation of the bibliography.

The kindness of Professor J. A. Allen, and Drs. Elliott Coues, C. Hart Merriam, A. K. Fisher and Robert Ridgway in reviewing a preliminary list, and suggesting important changes is most heartily appreciated. I have also received very great aid from the valuable manuals of Drs. Coues, Ridgway and Jordan, the excellent treatises of Samuels and Davie, and the other American works that treat of birds. I have been materially aided by my many students, especially Mr. C. B. Cook, A. B. Cook and L. Whitney Watkins, and by the many correspondents whose names appear in the text, especially Messrs. A. H. Boies, Hudson; Jerome Trombley, Petersburg; Stewart E. White, Grand Rapids; J. W. Simmons, Owosso; Robt. H. Wolcott, Grand Rapids; O. B. Warren, Palmer; N. A. Eddy, Bay City; W. A. Oldfield, Fort Sanilac; James Satterlee, Greenville; J. B. Steere, Ann Arbor; W. C. Brownwell, Morrice; J. B. Purdy, Plymouth; F. M. Falconer, Hillsdale; E. E. Brewster, Iron Mountain; Ludwig Kumlein, Milton, Wisconsin; E. L. Moseley, Sandusky, Ohio; H. Nehrling, custodian city museum, Milwaukee, Wisconsin; C. S. Osborn, Sault Ste. Marie; M. L. Leach, Traverse City; Dudley E. Waters, Grand Rapids; E. W. Durfee, Houghton, and L. S. Foster, New York City.

The admirable illustrations were received through the kindness of Messrs. Estes & Lauriat, and are the same that are used by Dr. Coues to illustrate his valuable manual of North American Birds. The illustration for the European Sparrow was received through the courtesy of Dr. Edwin Willits of the *Department of Agriculture.*

I have adopted the arrangement of the American Ornithological Union, and so give, after the serial number of each species, the number of the species as it occurs in the Union list. I have also appended in parenthesis, the number of the species as given in Coues' Key and Check List. This is for the convenience of beginners, who have or should have this valuable manual.

These numbers will prove of great convenience in correspondence and in making exchanges. Although I strongly recommend every student of birds and every would be student to procure Coues' Key to the Birds of North America, I have not used his arrangement or nomenclature, as they are not what he would use were he preparing his work today; but as I have given his numbers, there would be no difficulty in using this list and his invaluable book, which I regard as near perfection as any work of the kind which I have ever seen in any line of science. This list will enable any student to correct Coues' nomenclature according to the accepted nomenclature of the Ornithological Union, which was prepared by a committee of which Dr. Coues was himself a member. In the back part of the last edition of Dr. Coues' Key will be found the two nomenclatures side by side.

PECULIARITIES OF OUR MICHIGAN BIRD FAUNA.

Our bird fauna, like our entire fauna, owing to the protection given by the great lakes, which nearly surround us, is very interesting. As Dr. C. Hart Merriam has shown by a colored map, issued by the *Department of Agriculture* in March, 1892, we have three distinct faunæ represented in our State: The Boreal in the north, which includes our Northern Peninsula and the northern part of the Southern Peninsula; the Transition, which occupies nearly all of the Southern Peninsula and reaches slightly into Indiana and Ohio; and the Upper Sonoran which, though mostly to the south of us, reaches into the southeastern and southwestern corners of the State. Thus we meet in Michigan many birds peculiar to the far north, and others that dwell for the most part in the states and countries south of us, even reaching to or beyond the gulf. The first are illustrated in the Bohemian Wax-wing, the Spruce Partridge, the Canada Jay and the Pine Grosbeak; while the Summer Red Bird, the Mocking Bird and the Cardinal Red Bird illustrate the second group. The large lakes attract to us many birds that are usually maritime, like the gulls and the terns; while in southern Michigan, with its prairies and woodlands both widely distributed, we get the prairie fauna, illustrated in the Pinnated Grouse, as well as those birds which are most at home in the forests or wooded areas, like most of the thrushes and the warblers. This accounts for the very large list of woodland warblers which we find in our State.

The following birds have been reported from Michigan, but after as full inquiry as I have been able to make, I do not feel warranted in admitting them to this list: Sula bassana, Camptolaimus labradorius, Somateria mollissima boreallis, Ardea cœrulea, Nycticorax violaceus, Rallus longirostris crepitans, Tringa maritima, Pavoncella pugnax, Hæmatopus paliatus, Jacana spinosa, Dendragapus franklinii, Sayornis saya, Quiscalus quiscula, Milvulus tyrannus, Acanthis hornemanii exilipes, Ammodramus leconteii, Sitta pusilla, Parus carolinensis, and Sialia arctica. There are a few more that seem to be of very doubtful occurrence in our State, but I do not feel warranted in excluding them, but have expressed doubt as to their belonging to our Michigan fauna in the text.

I have appended to this introduction, not only as complete a bibliography as my time and resources would permit, but also our "Michigan Bird Laws," which are usually excellent, and very wholesome in their influence.

In the text I have recorded such facts regarding the food habits of our birds as will enable every one to judge of the economic importance of the various species. Where possible, as it is in most cases, I have given the food habits of the entire family and omitted mention of them in speaking of the separate species.

It will be observed that I have secured records from the southern part of the State from Messrs. Boies, Trombley, Warren and Simmons; from the southern central, from Messrs Purdy, Steere and Gibbs; from the central, from Messrs. Atkins, Brownell, White, Eddy, Moseley, etc.; from the north central, from Prof. Satterlee and others; from the northern extremity of the Southern Peninsula, from Messrs. Leach, White, Boise, Osborn, etc.; and from the Northern Peninsula, from Messrs. White, Boise, Brewster, Warren, Durfee, Kumlein, Kneeland and others. Thus the observations, most of them continued for a long series of years, and made by trained observers, have covered pretty thoroughly the entire State.

PROTECTION OF GAME.

[Act 276 of the Laws of 1889.]

2215h. Sec. 8. No person or persons shall kill or destroy, by any means whatever, or attempt to take or destroy, any wild turkey at any time except in the months of October and November of each year.

2215i. Sec. 9. No person or persons shall kill or destroy, by any means whatever, any woodcock or any partridge or ruffed grouse, save only from the first day of September in each year to the first day of January following.

2215j. Sec. 10. No person or persons shall kill or destroy, by any means whatever, any wild duck, wild goose, or other wild water fowl or snipe, save only from the first day of September in each year to the first day of January in the year following: *Provided, however*, That it shall be lawful to hunt and kill jack-snipe, red-headed, blue-bill, canvas-back, widgeon, pin-tail ducks and wild geese, between the first day of September in each year and the first day of May next following.

2215k. Sec. 11. The taking, carrying or sending by any means whatever into or through any county of this state, any of the game or animals which have been killed or captured contrary to the provisions of this act, or the hide of such animals, shall be illegal, and is declared to be an offense against the provisions of this act, in any county in or through which such game, animals, or hides may be taken.

2215l. Sec. 12. No person shall kill, capture, or destroy, or attempt to kill, capture, or destroy any colin or quail, sometimes called Virginia Partridge, before the first day of November, 1894, and thereafter only during the months of November and December of each year.

2215m. Sec. 13. No person shall kill or attempt to kill any pinnated grouse or prairie chicken until the first day of September, 1894, and thereafter only in the months of September and October in each year.

2215n. Sec. 14. No person or persons shall at any time take or capture or attempt to take or capture any turkeys, partridge, prairie chicken, pigeon, wild duck, wild goose or quail by means of nets, snares, pits, pitfalls, or cages: *Provided*, That it shall be lawful to trap quail and take them alive for the purpose of keeping them alive through the winter and for no other purpose whatever. Said quail are not to be transported to other places, but must be again liberated in the same place where they were caught when the weather is suitable in the spring.

2215o. Sec. 15. No person shall, at any time, make use of a swivel or punt gun for the purpose of killing, or attempting to kill, any wild duck or other wild fowl.

2215p. Sec. 16. No person shall, at any time, in any manner, rob, or destroy, or injure the nest of any wild duck or other wild fowl, nor in any manner kill or molest the same at night or at any other time on their nesting places.

2215q. Sec. 17. No person or persons shall sell or expose for sale or have in his possession for the purpose of selling or exposing for sale, any of the kinds or species of birds or animals protected by this act after the expiration of eight days next succeeding the times limited and prescribed for the killing of any such birds or animals: *Provided, however*, That it shall be lawful to expose for sale and to sell any live quail for the purpose of preserving the same alive through the winter. And it shall also be lawful for any person to take alive, on his own premises, at any time and in any manner, any wood duck, teal duck, or mallard duck, or wild turkey, for the sole purpose of domestication or for stientific or breeding purposes and possession and transportation alive of such wild fowl, so taken on one's own premises, may be had for any such purpose: *Provided*, That in any prosecution for violation of any of the provisions of this act, the person claiming the benefit of this section shall prove on the hearing or trial that in good faith he so took alive such wild fowl or fowls for one of the purposes specified in this section, and if prosecuted for transporting them, that he is in good faith transporting them alive for such purpose; and it shall not be necessary for the prosecution to aver or prove that the taking alive of any such wild fowl or fowls was not done for domestication or for scientific or for breeding purposes.

2215r. Sec. 18. Any person or persons violating any of the foregoing provisions of this act shall be deemed guilty of a misdemeanor, and shall likewise be liable to a penalty of fifty dollars for each offense, and shall, on conviction thereof, stand committed to the common jail of the county until such penalty is paid: *Provided*, That such imprisonment shall not exceed thirty days.

2215s. Sec. 19. Any person who shall, at any time, within this state, kill any robin, nighthawk, whippoorwill, finch, thrush, lark, swallow, yellow bird, blue bird, brown thrasher, wren, martin, oriole, woodpecker, bobolink, or any song bird, or rob the nests of such birds, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be fined five dollars for each bird so killed, and for each nest so robbed, or confined in the county jail for ten days, or both such fine and imprisonment in the discretion of the court.

2215t. Sec. 20. That any railroad, express company, or other common carriers, or any of their agents or servants or other persons having any of the above named birds or animals in their possession for transportation, or shall transport the same after the expiration of five days next succeeding the time limited and prescribed for the killing of such birds and animals, shall be punished by fine not less than ten dollars nor more than one hundred dollars: *Provided*, That no such penalty shall apply to the transportation of live quail which are to be kept alive throughout the winter, or to the transportation of such birds or animals in transit through the state from other states where it is lawful to kill such birds or animals at the time of such transportation.

2215u. Sec. 21. No person or persons shall use any gun or guns, or fire-arms to maim, kill, or destroy any wild pigeon or pigeons, at or within five miles of the place or places where they are gathered in bodies for the purpose of brooding their young, known as pigeon nestings; and no person or persons shall use any gun or guns, or fire-arms to maim, kill or destroy, any wild pigeon or pigeons within their roostings, anywhere within the limits of this state; and no person or persons shall, with trap, snare, or net, or in any other manner, take, or attempt to take, kill or destroy, or attempt to kill or destroy, any wild pigeon or pigeons, at or within two miles of such nesting place at any time from the beginning of the nesting until after the last hatching of such nesting, anywhere within the limits of this state; and every person offending against the provisions of this section, or any part thereof, shall be subject to a penalty of fifty dollars with costs of suit.

2215v. Sec. 22. A prosecution may be brought by any person in the name of the people of the state of Michigan, against any person or persons violating any of the provisions of this act before any justice of the peace of the county in which such violation is alleged to have taken place, or before any court of competent jurisdiction; and it is made the duty of all prosecuting attorneys in this state to see that the provisions of this act are enforced in their respective counties, and they shall prosecute all offenders, on receiving information of the violation of any of the provisions of this act; and it is made the duty of sheriffs, under sheriffs, deputy sheriffs, constables and police officers, to inform against and prosecute all persons who there is probable cause to believe are guilty of violating any of the provisions of this act.

2215w. Sec. 23. The state game and fish warden is hereby authorized to issue permits for the hunting and killing any kind of bird out of season, said bird being sought exclusively as specimens for scientific purposes.

2215x. Sec. 24. All prosecutions under the provisions of this act shall be commenced within one year from the time such offense was committed.

2215y. Sec. 25. All acts and parts of acts in conflict with the provisions of this act are hereby repealed.

DESTRUCTION OF ENGLISH SPARROWS.

2259a. *1885, p. 4, Feb. 17, act 4.* Section 1. *The People of the State of Michigan enact,* That it shall be lawful to kill the birds commonly called "English Sparrows."

Sec. 2. All acts heretofore passed, contrary to the provisions of the preceding section, are hereby repealed.

2259b. *1887, p. 29, Mar. 15, act 29; Am. 1889, p. 171, June 17, act 152.* Section 1. *The People of the State of Michigan enact,* That every person being an inhabitant of this state, who shall kill an English sparrow in any organized township, village or city in this state shall be entitled to receive a bounty of three cents for each sparrow thus killed, to be allowed and paid in the manner hereinafter provided.

2259c. *Am. Ib. 1889.* Sec. 2. Every person applying for such bounty shall take such sparrow, or the head thereof, in lots of not less than ten, to the clerk of the township, village or city, within which such sparrow shall have been killed, who shall thereupon decide upon such application, and if satisfied of the correctness of such claim, shall issue a certificate stating the amount of bounty to which such applicant is entitled and deliver the same to said applicant, and shall destroy the heads of such sparrows.

2250d. *Am. Ib. 1889.* Sec. 3. Such certificate may be presented by the claimant or his agent to the county clerk of the county in which such sparrow or sparrows have been killed, who shall thereupon draw a warrant for the amount on the treasurer of said county, and said treasurer shall, upon presentation of said warrant, pay the same from the general or contingent fund of said county.

[Act No. 51 of the Laws of 1893.]

AN ACT to amend sections one and two of act number one hundred and fifty-two of the session laws of eighteen hundred and eighty-nine, being "An act to amend sections one, two and three of act number twenty-nine of the public acts of eighteen hundred and eighty-seven, approved March fifteen, eighteen hundred and eighty-seven, entitled 'An act to provide for the payment of bounties for the killing of English sparrows,'" as amended by act number one hundred and fifty-two of the public acts of eighteen hundred and eighty-nine.

SECTION 1. *The People of the State of Michigan enact,* That sections one and two of act number twenty-nine of the public acts of eighteen hundred and eighty-seven, approved March fifteen, eighteen hundred and eighty seven, entitled "An act to provide for the payment of bounties for the killing of English sparrows," as amended by act number one hundred and fifty-two of the public acts of eighteen hundred and eighty-nine, be amended so as to read as follows:

SECTION 1. *The People of the State of Michigan enact,* That every person being an inhabitant of this state, who shall kill, "during the months of November, December, January, February and March," an English sparrow in any organized township, village, or city in this State, shall be entitled to receive a bounty of three cents for each sparrow thus killed, to be allowed and paid in the manner hereinafter provided.

SEC. 2. Every person applying for such bounty shall within said months take such sparrows, in lots of not less than ten, to the clerk of the township, village or city, within which such sparrows shall have been killed, "and shall thereupon make oath that such sparrows were killed during the aforesaid months mentioned in section one of this act and at no other time."

Said clerk shall thereupon decide upon such application, and if satisfied of the correctness of such claim, shall issue a certificate stating the amount of bounty to which such applicant is entitled and deliver the same to said applicant, and shall destroy such sparrows.

This act is ordered to take immediate effect.

Approved April 27, 1893.

GAME AND FISH WARDEN.

2197r. *1887, p. 27, Mar. 15, act 28.* SECTION 1. *The People of the State of Michigan enact,* That it shall be the duty of the Governor to appoint some person, a resident of this state, game and fish warden. Said warden shall hold his office for four years, or until his successor has been appointed and qualified, unless removed for cause by the Governor; he shall receive a salary of twelve hundred dollars per annum, payable monthly, and shall also be reimbursed his actual expenses necessarily incurred by him while engaged in the performance of his duties, to be paid on the warrant of the auditor general, monthly, on the approval of his vouchers therefor.

2197s. SEC. 2. It shall be the duty of said game and fish warden to enforce the statutes of this state for the preservation of moose, wapiti, deer, birds and fish, and to enforce all other laws of this state for the protection and propagation of birds, game and fish, now in force or hereinafter enacted, and to bring or cause to be brought actions and proceedings in the name of the people of this state to punish any parties for the violation of said statutes and laws. Such actions and proceedings may be brought in the name of the people, in the like cases, in the same courts, and under the same circumstances as they may now or at any time hereafter be brought by any individual or by the prosecuting attorneys of the several counties under and by virtue of any laws now existing or hereafter enacted.

2197t. SEC. 3. Said warden may make complaint and cause proceedings to be commenced against any person for the violation of any of the laws for the protection or propagation of game or fish without the sanction of the prosecuting attorney of the county in which such proceedings are commenced, and in such case he shall not be obliged to furnish security for cost.

2197u. SEC. 4. Said game and fish warden shall have the same power to serve criminal process as sheriffs, and shall have the same right as sheriffs, to require aid in executing such process. Said warden may arrest, without warrant, any person caught by him in the act of violating any of the aforesaid laws for the protection or propagation of birds, game or fish, and take such person forthwith before a justice of the peace, or other magistrate having jurisdiction, who shall proceed without delay to hear, try and determine the matter, and the same proceedings shall be had as near as may be, as in other criminal matters triable before a justice of the peace, or other magistrate having jurisdiction. Such arrests may be made on Sunday, in which case the person arrested shall be taken before a justice of the peace, or other magistrate having jurisdiction, and proceeded against as soon as may be on a week day following the arrest.

2197v. SEC. 5. Said warden shall, in the month of December in each year, file in the office of the auditor general, an account in writing, stating the days and parts of days spent in the discharge of his duty, the kind of service rendered and the places where rendered, and the expenses paid or incurred in the time of the discharge of such duties, which account shall be verified by the oath of said warden stating that the same is correct and true in every particular.

2197w. SEC. 6. Said warden shall, at the close of each calendar month, file with the secretary of state a report in writing, and in detail, stating the service performed by him during the last preceding month, including an account of the suits commenced at his instance, as herein provided for, the disposition made of the same, the result of any brought to trial, and the condition of any undisposed of, and any other particulars he may think proper, and no payment for services performed or expenses paid by said warden shall be made until he shall present to the auditor general, in addition to the usual oath of performance and payment, a certificate from the said secretary that he has made the report required by this act. The secretary of state shall cause the monthly reports of said warden, or so much thereof as may be of interest to the public, to be transmitted annually to the legislature when in session.

2197x. SEC. 7. The said game and fish warden shall have power to appoint a deputy or deputies, not exceeding three, in each county, who shall be residents thereof; said deputies shall have the same powers in their respective counties as herein provided for the warden himself, subject to the supervision and control of the warden. Said deputy warden or wardens shall receive such compensation as the board of supervisors of the counties in which such deputy warden or wardens reside may allow and provide for, except in the county of Wayne, where such compensation shall be fixed by the board of county auditors.

[Act No. 48 of the Laws of 1893.]

AN ACT to amend section two of an act number seventy, of the public acts of one thousand eight hundred and seventy-seven, entitled an "Act for the more effectual prevention of cruelty to animals," approved April twenty-fifth, eighteen hundred seventy-seven, being section nine thousand three hundred and ninety-two of Howell's Annotated Statutes.

SECTION 1. *The People of the State of Michigan enact*, That section two of act number seventy of the public acts of one thousand eight hundred and seventy-seven, entitled "An act for the more effectual prevention of cruelty to animals," approved April twenty-fifth, eighteen hundred seventy-seven, being section nine thousand, three hundred and ninety-two of Howell's Annotated Statutes, be and the same is hereby amended so as to read as follows:

SEC. 2. Any person who shall keep or use any bull, bear, dog, cock, or other animal or fowl, or bird, except English sparrows, for the purpose of fighting or baiting, or as a target or to be shot at, either for amusement, or as a test of skill in marksmanship; and any person who shall be a party to, or be present as a spectator, at any such fighting, baiting, or shooting of any bear, dog, cock, or other animal, or fowl, or bird, except English sparrows, and any person who shall rent any building, shed, room, yard, ground or premises, for the purpose of fighting, baiting or shooting any animal, fowl, or bird, except English sparrows, as aforesaid, or shall knowingly suffer or permit the use of any building, shed, room, yard, ground or premises belonging to him or under his control, for either or any of the purposes aforesaid, shall on conviction thereof, be adjudged guilty of a misdemeanor: *Provided*, That no bounty shall be paid for any English sparrow that may be killed when used as a target, or to be shot at either for amusement or as a test of skill in marksmanship: *And provided*, That it shall not be lawful for any person or persons to engage in the propagation of English sparrows for the purpose allowed in this act or for any other purpose; and that on conviction for each or any offense mentioned in this act, the person or persons so convicted shall pay a fine of not less than ten (10) nor more than fifty (50) dollars or be imprisoned in the county jail for a period of not more than ninety (90) days, or by both such fine and imprisonment in the discretion of the court.

This act is ordered to take immediate effect.

Approved April 27, 1893.

[Act No. 105 of the Laws of 1893.]

AN ACT providing for the protection of Antwerp and homing pigeons.

SECTION 1. *The People of the State of Michigan enact*, That on and after the passage of this act it shall be unlawful for any person or persons to wilfully shoot, maim or kill any Antwerp or homing pigeon, either in flight or at rest, and any person guilty of wilfully killing, shooting or maiming such pigeon or pigeons as aforesaid, shall be guilty of a misdemeanor and upon conviction thereof shall for every such offense pay a fine of not less than ten nor more than twenty-five dollars, or be punished by imprisonment in the county jail not to exceed ninety days, or by both such fine and imprisonment in the discretion of the court.

SEC. 2. That it shall be unlawful for any person or persons to detain or entrap any Antwerp or homing pigeon: *Provided, however*, That such Antwerp or homing pigeon shall have the name of its owner stamped on its wing or tail, or which may be identified by any device or mark, and any person or persons so detaining such pigeon or pigeons shall be deemed guilty of a misdemeanor, and upon conviction thereof before any justice of the peace or other court of competent jurisdiction shall for every offense pay a fine of not less than ten or not more than twenty-five dollars or be punished by imprisonment in the county jail not exceeding ninety days, or both such fine and imprisonment at the discretion of the court.

This act is ordered to take effect June first, eighteen hundred and ninety-three.

Approved May 24, 1893.

[Act No. 24 of the Laws of 1893.]

AN ACT to prevent the killing, hunting, or molesting in any way of Mongolian and English pheasant for a period of five years, and to regulate the time for hunting and for selling or offering for sale the same after that period.

SECTION 1, *The People of the State of Michigan enact*, That no person or persons shall pursue, hunt, kill, or attempt to kill or molest in any way whatever any Mongolian and English pheasants until the first day of November, eighteen hundred and ninety-eight, and then only from the first day of November to the fifteenth day of December, inclusive, in each year.

SEC. 2. No person, firm, or corporation, shall for a period of ten years from and after the passage of this act sell, or attempt to sell, or expose for sale, or ship or transport outside of this state, or attempt to ship or transport outside of this state or have in possession for the purpose of shipping or transporting outside of this state any Mongolian and English pheasant.

SEC. 3. Any person or persons violating the provisions of this act shall be guilty of a misdemeanor, and on conviction thereof shall be punished by a fine of not less than ten dollars nor more than fifty dollars, together with the costs of prosecution, and in default of the payment of the same shall be imprisoned in the county jail for a period not exceeding thirty days, or both such fine and imprisonment, in the discretion of the court.

Approved March 30, 1893.

GENERAL LITERATURE.

Coues, Dr. Elliott, 1890—Key to North American Birds. Very fully illustrated. This work is very complete and admirable, an excellent manual in my judgment, for either the beginner or advanced student. The complete anatomy, full descriptions, excellent artificial key, and admirable illustrations make it indispensable to every student of ornithology. The nomenclature and arrangement are not the latest, but an appendix corrects this, in a manner that is very convenient and desirable. Price $7.50. Estes & Lauriat, Boston, Mass.

Ridgway, Robert, 1889—Manual of North American Birds. This is simply a manual, and is very excellent for one who wishes simply to study systematic ornithology.

The nomenclature and arrangement are recent. Price $7.50. J. B. Lippincott, Philadelphia, Pennsylvania.

Jordan, Dr. David Starr. 1888—Manual of the Vertebrates of the Northern United States. This is very brief but valuable to every zoölogist. This succinct key helps us to identify all vertebrate animals from fish to mammals, inclusive. It is very satisfactory, considering its size. All three of the above works refer more or less to Michigan birds. Price $2.50. Jasen McClurg & Co., Chicago, Illinois.

Davie, Oliver, 1889—Nests and Eggs of North American Birds. A few illustrations. This work is very full and accurate, and very valuable to one wishing to study the nesting habits of birds. There are many references to Michigan species. Price $1.75. Hann & Adair, Columbus, Ohio.

Standard Natural History of the United States, Vol. IV. This large work is almost indispensable to the working naturalist. It is to be regretted that its size and cost place it beyond the reach of many. It is fully illustrated and embraces the ornithology of the whole world. It also treats of all other classes of animals, and is very complete. S. E. Cassino & Co., Boston, Massachusetts.

The Auk. A very excellent monthly magazine, devoted to ornithology; the organ of the American Ornithologists' Union and the successor to the Bulletin of the Nuttall Ornithological Club. Its editors and contributors are among the ablest ornithologists in the country or the world. The magazine is a credit to our science and literature. Price $3.00 a year. L. S. Foster, 35 Pine street, New York City.

The Ornithologist and Oölogist. This is a much less pretentious journal than The Auk, but is very interesting and valuable to the student of birds. Like the last mentioned, this contains much regarding our Michigan birds. It is especially valuable to the young ornithologist. Price $1.00. Frank Blake, Webster Co., Hyde Park, Massachusetts.

Forest and Stream. This weekly journal is more of a sportsman's paper, but contains much that is helpful to the scientist. Several excellent lists of Michigan birds have appeared in this journal. Price $4.00 per year. Forest and Stream Publishing Co., 318 Broadway, New York City.

The Oölogist. This valuable journal has already passed to its tenth volume. It is more than its name implies as it treats of general ornithology as much as of eggs. It has, like all of the above, many able contributors from Michigan. Price 50c per year. Frank H. Lattin, Albion, N. Y.

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Allen, J. A., 1878. "Rare Birds of Michigan," Bull. Nutt. Orn. Club, Vol. IV, p. 123. Statement of Western Meadow Lark and Oregon Snow Bird in Michigan on the authority of Dr. H. A. Atkins.

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*A few of these references I have not been able to verify, and so there may be an occasional error.

Allen, J. A. 1879. "Gibbs' List of Birds of Michigan," review of, Bull. Nutt. Orn. Club, Vol. V, p. 110.

Allen, J. A., 1880. "Steere's Birds of Ann Arbor," review of, Bull. Nutt. Orn. Club, Vol. VI, p. 46.

Allen, J. A. 1893. "The Geographical Origin and Distribution of North American Birds, Considered in Relation to the Faunal Areas of North America," The Auk, Vol. X, No. 2, April 1893, pp. 97–150.

Anonymous, 1880. "Wild Pigeons in Michigan," Scientific American, Vol. 42, pp. 343–344. Notes on breeding and migrations, copied from the Detroit Post.

Anonymous, 1887. "The Evening Grosbeak at Saginaw, Michigan," Forest and Stream, Vol. XXXIV, p. 143.

Anonymous, 1892. "Capture of a Pelican near Grand Rapids," Ornithologist and Oölogist, Vol. XVII, p. 143. Copied from Grand Rapids paper. The bird was exhibited by G. K. Hurlburt.

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Atkins, Dr. H. A., 1880, "Orange Crowned Warbler," taken at Locke, Oölogist, Vol. V, p. 72.

Atkins, Dr. H. A., 1881. "Bird Notes from Michigan," Ornithologist and Oölogist, Vol. VI, 1881; "Small Green-crested Flycatcher," ibid., Vol. VI, 1881, dates of arrival are given for twenty-five consecutive years; "The Whip-poor-will," ibid., Vol. VI, No. 6, 1881; "Date of Arrival of Scarlet Tanager and Baltimore Oriole for twenty-five years," ibid., Vol. VI, No. 2, 1881.

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Atkins, Dr. H. A., 1882. "Our two Cuckoos breeding in one nest," Ornithologist and Oölogist, Vol. VII, 1882, p. 189; "Tufted Titmouse," ibid., Vol. VII, 1882.

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Gibbs, Dr. Morris, 1893. "The American Osprey," Oölogist, Vol. X, No. 2, Feb. 1893, p. 39.

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Gunn, Chas. W.. 1878. "The Western Loggerhead. White rumped Shrike. *Collyrio excubitorides*," Naturalist and Fancier. Vol. II. 1878; "The Evening Grosbeak, *Hesperiphona vespertina* Bp.," ibid., Vol. III, 1878.

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Gunn, Chas. W.. 1881. "Arrivals," Ornithologist and Oölogist, Vol. VI, 1881. Embraces notes on spring migrants.

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Hatch, Dr. P. L., 1890. "Great Gray Owl," "Notes on Birds of Minnesota," 1890, p. 211. Its habitat in Michigan is noted.

Hatch. Dr. P. L., 1892. "Notes on the Birds of Minnesota," First Report of State Zoölogist, p. 487. Describes the birds of Minnesota, and refers to Michigan birds.

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Hewett, Alexander, 1880. "Birds Should be Fostered," Report State Pomological Society, 1880, p. 4.

Hollister, Geo. C., 1886. "Albino Robin at Grand Rapids," Ornithologist and Oölogist, Vol. XI, p. 118.

Hubbard, Bela, 1888. "Memorials of a Half Century," G. B. Putnam's Sons, pp. 279–320, treat in a popular way of our most common and best known birds.

Hughes, D. Darwin, 1869. "Birds Calhoun County," Marshall Democrat Expounder 1869. This embraces 179 species; "The Bobolink," ibid., May 5, 1870; "The Wild Turkey," Detroit Free Press, Jan. 24, 1870; "The Sora Rail," ibid., March 16, 1870; "The Different Species of the Plover Family," ibid., Apr. 3, 1870; "The Ruffed Grouse," ibid., Oct. 7, 1870; "Song Birds of Michigan," ibid., Feb. 12, 1871; "The Robin, Bluebird and Catbird," ibid., Feb. 19, 1871; "The Pinnated Grouse or Prairie Chicken, *Cupidonia cupido*," ibid., March 24, 1871. The following species were also described by Mr. Hughes in the Free Press for 1871, special date unknown: The American Quail, Field Sparrow, the smaller Thrushes, Brown Thrush, Wilson's Snipe, American Woodcock, Wood Thrush and Song Sparrow. This whole series of articles is very excellent.

Hughes, D. Darwin, 1870. "The Wild Turkey, Its Origin and Habits," The Moderator (Michigan school paper, published at Grand Rapids). Vol, IV, No. 19, p. 373. This is a reprint of article in Free Press for Jan. 24, 1870.

Hughes, D. Darwin, 1872. "Michigan Birds, Their Relation to Agriculture," Report of the Michigan Pomological Society, 1872, p. 442. This discusses our bird friends and includes the Hawks and others which are often condemned.

Hughes, Walter H., 1871. "Arrival and departure of the Snow Bunting, *Plectrophanes nivalis* (Linn.) Meyers, from 1867 to 1871," Naturalist and Fancier (Grand Rapids), Vol. 1, No. 11, 1877. Extract from the notes of his father, Hon. D. D. Hughes; "*Chrysomitris tristis*" Bp., ibid., Vol. II, No. 1. 1878; "The Michigan Plover," ibid., Vol. II, No. 3, 1878, a reprint of an article by Hon. D. D. Hughes.

Hughes, Walter H., 1878. "Birds of Michigan," Valley Naturalist (St. Louis, Mo.). Vol. I, 1878, pp. 11, 14, 15, 34 and 35. This is an annotated list.

Judson, R. F., 1892. "Brief Notes," Ornithologist and Oölogist, Vol. XVII, p. 9. Notes Golden Eagle taken in Kalamazoo, Michigan, Jan. 1, 1892.

K. D. H., 1886. "The Bald Eagle at Sturgis, Michigan," Ornithologist and Oölogist, Vol. IX, p. 75.

Kennicott, R., 1861. "A Catalogue of the Trowbridge Collection of Natural History in Michigan University Museum." Pamphlet of thirty-two pages published by University at Ann Arbor, 1861.

Kneeland, Dr. S., Jr., 1857. "Birds of Keweenaw Point," Boston Society of Natural History, Vol. VI, 1857, pp. 231 to 241 inclusive. This list was made as the result of one year's study during a residence at Portage Lake and is undoubtedly very accurate and reliable. It includes 147 species.

L. M., 1891. "The Wild Turkey in Michigan." Shooting and Fishing, Dec. 3, 1891, p. 107.

Langille, Rev. J. H., 1886. "Nidification of Birds on the St. Clair Flats," Bull. Buffalo Society of Natural Sciences, Vol. V. No. 1, 1886, pp. 33 to 39. Treats chiefly of water birds; "American Coot, *Fulica Americana*," *Our Birds and their Haunts*, pp. 405 and 406. Gives breeding habitat along the great lakes, and says it is the characteristic bird of the St. Clair Flats.

Lawrence, Robt. B. "Brant in Michigan," Forest and Stream, Vol. XXXII, p. 316.

Lockwood, E. A., 1891. "Snowy Owls and Swans taken at South Haven." Ten owls and two swans taken in December. American Field, Vol. XXVII.

Lucius, E. Torrey, 1883. "The English Sparrow," Agricultural World, Grand Rapids, Vol. IX, No. 4.

M., 1867. "Nesting of Pigeons at Shelby, Michigan." Forest and Stream, Vol. XIV, pp. 231-232. Describes a pigeon roost.

Maris, Willard L., 1891. "The Rose-breasted Grosbeak in Washtenaw county," Oölogist, Vol. XVI, p. 106.

McBride, Herbert W., 1893. Letter, Ornithologist and Oölogist, Vol. XXIII, 1893, p. 47. Notes, breeding of Rose-breasted Grosbeak in Berrien county, Michigan.

McBride, Herbert W., 1893. "Note on Pine Grosbeak in Southwestern Michigan," Ornithologist and Oölogist, Vol. XVIII, p. 47.

Merriam, Dr. C. Hart, 1883. "Kirtland's Warbler from the Straits of Mackinaw." The Auk, Vol. I, p. 376. Mentions several birds received from Wm. Marshall, keeper of lighthouse at Spectacle Reef, Michigan, killed night of May 21, 1883. Among them was a male, Kirtland's Warbler.

Miles, Dr. M., 1861. "Catalogue of Birds of Michigan," Geological Survey of Michigan, pp. 222 to 232 inclusive. There are 203 species embraced in this list, which illustrates the characteristic accuracy of its author.

Milliken, W. E., 1892. "Nesting of a Chimney Swift in a Freight Car," Ornithologist and Oölogist, XVII, p. 159; "The Rose-breasted Grosbeak in Michigan," XVII, p. 152. Reported quite common in Kent county.

Mills, M. B., 1891. "Set of Ten Eggs from White-breasted Nuthatch, taken at Macon, Michigan," Ornithologist and Oölogist, Vol. XVI, p. 157.

Morden, John A., 1893. "Notes from Isabella county, Michigan." Oölogist, Vol. X, No. 1, Jan. 1893, p. 24. Notes on Saw-whet Owl, Marsh Hawk, etc.

Morden, John A., 1893. "A Collector's Gun." Oölogist, Vol. X, No. 4, April, 1893.

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Swales, B. H., 1892. "Brief Notes," Ornithologist and Oölogist, Vol. XVII, p. 75. Gives notes of the winter; "Rose-breasted Grosbeak in Wayne County," ibid., p. 64. "American Long-eared Owl Breeding in Wayne County, Michigan," ibid., p. 75; "Brief Notes," ibid., p. 79; Bald Eagle at Detroit, April 4, and eggs of Red-shouldered Hawk taken April 13. "Nesting of Virginia Rail at St. Clair Flats," ibid., p. 103; "Nesting of Phoebe," ibid., p. 111; "Albino Eggs of the Long-billed Marsh Wren," ibid., p. 121; "Nesting of the Field Sparrow in Michigan, found Nesting August 2," ibid., p. 159; "Notes on Tame Red-shouldered Hawk," ibid., p. 159.

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Van Winkle, 1893. "The Caspian or Imperial Tern," Oölogist, Vol. X, No. 4, April, 1893, p. 114. Recounts extensive breeding with Gulls on Gull Island in Lake Michigan.

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Waters, Dudley E., 1883. "The English Sparrow, *Passer domesticus*," Agricultural World (Grand Rapids), Vol. IX, No. 4.

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White, S. E., 1890. "Brown Creeper at Grand Rapids, Michigan," Ornithologist and Oölogist, Vol. XV, pp. 101–102; "Favors the Old Names," ibid., p. 137; "Two Days in the Field," ibid., pp. 173–174. Notes on the birds of Mackinac Island.

White, S. E., 1891. "The Picidæ of Michigan," Ornithologist and Oölogist, Vol. XVI, pp. 56–59; "Stupid Bird Laws of Michigan," ibid., p. 92; "A Pleasant Disappointment," ibid., pp. 100–101. An account of a visit to a heronry and other bird notes; "Turkey Buzzard Breeding in Michigan," ibid., p. 141. Notes the breeding of this and other species along the Kalamazoo river; "Winter Birds with Dates," ibid., p. 149.

White, S. E., 1892. "The Olive-backed Thrush," Ornithologist and Oölogist, Vol. XVII, pp. 114–115. Notes from Kent county and Mackinac Island.

White, S. E., 1893. "Birds Observed on Mackinac Island, Michigan, During the Summers of 1889, 1890 and 1891." The Auk, Vol. X, No. 3, July, 1893, pp. 221–230. Notes, often quite copious, are made on 148 species.

Wolcott, Robt. H., 1884. "Notes from Grand Rapids, Michigan," Ornithologist and Oölogist, Vol. IX, p. 62. Refers to early spring birds.

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BIRDS OF MICHIGAN.

ORDER PYGOPODES. DIVING BIRDS.

SUBORDER PODICIPEDES. GREBES.

FAMILY PODICIPIDÆ. GREBES; HELL-DIVERS.

These curious birds are mostly confined to the water and are great divers, said to dodge even the rifle ball.

GENUS ÆCHMOPHORUS COUES.

1-1-(845). Æchmophorus occidentalis (*Lawr.*). WESTERN GREBE.

Very rare; probably accidental; one specimen killed near Lansing and now in the collection of Mr. C. H. Davis; one specimen reported in catalogue of "Kent Scientific Institute" by E. L. Mosley; included in "Butler's Birds of Indiana."

GENUS COLYMBUS LINN.

2-2-(847). Colymbus holbœllii (*Reinh.*). RED-NECKED GREBE; HOLBŒLL'S GREBE.

Very rare; migrant; we have one from Saginaw Bay; "One taken by Prof. Smith at Hillsdale, in the spring of 1890, and now in the Hillsdale College museum" (F. M. Falconer); taken by S. E. White off Mackinac Island; "taken occasionally at Sault Ste. Marie" (C. S. Osborn). This species is included in the list of Fox and in that of Dr. A. Sager of 1839.

3-3-(848). Colymbus auritus *Linn.* HORNED GREBE.

Common throughout the state; "one taken Feb. 26, 1892, snow bound in Pittsford township, Hillsdale county" (A. H. Boies); "tolerably common spring and fall migrant on Saginaw Bay, common on Heisterman's Island during the fall months, a perfect albino was taken, Oct., 1883" (N. A. Eddy); "took four males and two females at Port Sanilac which are now mounted and in my collection, saw several along lake shore from May 15 to July 1. I think they breed on Black River, six miles west of here" (W. A. Oldfield); fall and spring migrant; occasional in summer; "northern U. S." (Jordan); "Iron Mountain, May 18, 1890" (E. E. Brewster); "Keweenaw Point" (Kneeland); breeds; nests in May, on bogs in marshes; "breeds in Wayne county" (B. W. Swales); O. B. Warren informs me that, though a rare migrant at Albion, it is very common in the marshes of the St. Joseph and Paw Paw rivers where it breeds abundantly; a fine male was taken by J. B. Purdy at Plymouth; "rare transient in

Kalamazoo county in spring and autumn" (Dr. M. Gibbs); "rivers of Michigan" (Davie's Nests and Eggs of North American Birds. p. 3); eggs, five to nine, immaculate, yellowish, smooth; "breeds among the lakes and marshes of northern Indiana in considerable numbers" (Butler's Birds of Indiana).

GENUS PODILYMBUS LESS.

4-6 (852). Podilymbus podiceps (*Linn.*). *PIED-BILLED GREBE; CAROLINA GREBE; HELL-DIVER; WATER-WITCH; DIPPER; DIDAPPER DABCHICK.

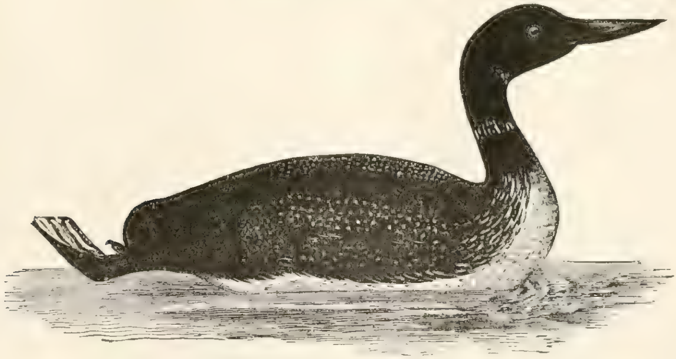
Very common; "throughout the state and easily shot by the skillful hunter" (A. H. Boies); April till fall; "Monroe County" (Jerome Trombley); Mackinac Island" (S. E. White); "common at Iron Mountain, Dickinson County" (E. E. Brewster); "Keweenaw Point" (Kneeland); breeds; nests as in last species; "found breeding on St. Clair Flats" (W. H. Collins, Oölogist, Vol. V, p. 19); "very common at Port Sanilac in spring and summer, breeds in creeks along the lake shore" (W. A. Oldfield); "breeds abundantly about St. Joseph" (O. B. Warren); "Geo. Sprague of Kalamazoo, secured thirty-two eggs in a half day, about ponds and lakes" (Dr. M. Gibbs); eggs, five to nine, rough, dirty yellowish white. The nest of this species often floats. This queer tailless bird is the cause of many stories told by hunters. They report that it will dodge a bullet as the most skillful hunter seldom takes one. It certainly might and generally would dive even after receiving a mortal wound. Prof. James Satterlee, Greenville, writes me: "This comes from the habit of diving so quickly after the flash of the gun. I shot five in one day with my rifle." Geo. D. Sones writes: "They dive at sight of flash, and so escape the bullet," as he has actually observed many times.

SUBORDER CEPPHI. LOONS AND AUKS.

FAMILY URINATORIDÆ LOONS.

These are pre-eminent water birds, noted for swimming and diving.

GENUS URINATOR CUV.



Loon.

5-7-(840). Urinator imber (*Gunn.*). *LOON; GREAT NORTHERN DIVER.

Very abundant in spring, summer and autumn; throughout the state; Grand

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*All species starred were reported from Locke, Ingham County, by the late Dr. H. A. Atkins.

Traverse Co." (Dr. M. L. Leach); " nests have been found in Washtenaw Co. on muskrat houses about marshy lakes " (L. W. Watkins); common on Lake Erie and Raisin River (Jerome Trombley); " tolerably common on Saginaw Bay where numbers are taken in the numerous fish nets, especially in the spring, observed on Lake Huron off Sand Beach " (N. A. Eddy); " quite common at Port Sanilac in May to July 15. I took eleven this spring which are mounted and in my collection. They get in the trap nets set for fish, and as they cannot rise over them they fall an easy prey " (W. A. Oldfield); " Mackinac Island " (S. E. White); " common at Iron Mountain " (E. E. Brewster); " Keweenaw Point " (Kneeland); " common migrant at Albion, and breeds commonly at Palmer, Marquette Co." (O. B. Warren); breeds plenteously ; nests in May, in marshes, on large masses of grass, sedges, etc.; eggs two, very rarely three; elongate, olive brown or drab, spotted with darker, often almost black markings ; seen in winter ; " will carry their young on their backs, even when flying from one lake to another for two miles " (A. H. Whitehead). Dr. Atkins took several of these birds in March and April. I have taken them, or seen them in nearly all seasons of the year.

6-9 (842). **Urinator arcticus** (*Linn.*). BLACK-THROATED LOON ; BLACK-THROATED DIVER.

Exceedingly rare ; Lake Michigan ; winter ; " occasionally on Lake Michigan " (Gibbs' Birds of Michigan); " Upper Peninsula " (A. H. Boies); " Keweenaw Point " (Kneeland).

7-11-(844). **Urinator lumme** (*Gunn.*). RED-THROATED LOON ; RED-THOATED DIVER.

Rather common ; " throughout the state, have taken several alive on snow in winter " (A. H. Boies); winter ; migrates north in spring ; found on lakes and rivers in all parts of the state ; " almost a yearly visitor in Kalamazoo Co." (Dr. M. Gibbs); " Keweenaw Point " (Kneeland); " found breeding at Green Bay, Wisconsin " (Prof. Ludwig Kumlein); " breeds in arctic regions " (Dr. A, K. Fisher).

FAMILY ALCIDÆ. THE AUKS.

These curious water birds are specially marine and it is doubtful if they belong to our fauna ; if ever seen here they are undoubtedly wanderers.

GENUS FRATERCULA BRISS.

8-13-(854). **Fratercula arctica** (*Linn.*). COMMON PUFFIN.

" Rare straggler " (Gibbs' Birds of Michigan); " have never heard of one on Lake Superior " (C. S. Osborn). I think this of doubtful occurrence in Michigan.

GENUS SYNTHLIBORAMPHUS BRANDT.

9-21-(864). **Synthliboramphus antiquus** (*Gmel.*). ANCIENT MURRELET ; BLACK-MURRELET.

Prof. Ludwig Kumlein writes me that he has taken one specimen at Lake Koshkonong, Wisconsin, and one on Lake Michigan. One was shot late in October by Rev. G. E. Gordon on Lake Koshkonong, Wisconsin (Geo. B. Sennett in the Auk for January, 1884). Coues says one straggler taken in Wisconsin.

GENUS CEPPHUS PALL.

10–27–(871). Cepphus grylle (*Linn.*) BLACK GUILLEMOT.

"Not rare in Upper Peninsula, occasional seasons" (Dr. M. Gibbs); "may occur as a rare straggler" (Prof. Ludwig Kumlein); "very rare even as an accidental visitor" (C. S. Osborn).

GENUS URIA BRISS.

11–30–(874). Uria troile (*Linn.*). MURRE.

"Occasionally taken on Lake Superior" (Gibbs' Birds of Michigan). I think this a doubtful Michigan bird; "so do I—also all the other Alcidæ" (Robt. Ridgway).

GENUS ALCA LINN.

12–32–(877). Alca torda *Linn.* RAZOR-BILLED AUK.

"Irregular visitor to Northern Peninsula" (Gibbs' Birds of Michigan); I have heard of one captured, but even this is not well authenticated" (C. S. Osborn); "the chances are one hundred to one against the five preceding species appearing in Michigan even as wanderers, especially is this true of *Fratercula arctica*" (Prof. J. A. Allen); "I concur with Prof. Allen" (A. H. Boies).

GENUS ALLE LINK.

13–34–(863). Alle alle (*Linn.*). SEA DOVE; DOVEKIE.

The late W. H. Collins reported killing one on Detroit River, Nov. 30, 1881 (O. and O., Vol. VII, p. 111.

ORDER LONGIPENNES. LONG-WINGED SWIMMERS.

FAMILY STERCORARIIDÆ. SKUAS AND JAEGERS.

GENUS STERCORARIUS BRISS.

14–36–(765). Stercorarius pomarinus (*Temm.*). POMARINE JAEGER.

Very rare; one taken on Beaver Island, Michigan, by Prof. Ludwig Kumlein. Reported (Butler's Birds of Ind.) from Lake Michigan; E. L. Mosley reports a specimen shot at Sandusky, O., October, 1889; the late W. H. Collins reported one specimen taken on Detroit River, and now in the collection of the Museum of Comparative Zoölogy, Cambridge, Massachusetts.

FAMILY LARIDÆ. GULLS AND TERNS.

More common near the Great Lakes; feed on fish and meat; the larger gulls often accompany vessels.

SUBFAMILY LARINÆ. GULLS.

GENUS RISSA LEACH.

15–40–(782). Rissa tridactyla (*Linn.*). KITTIWAKE; KITTIWAKE GULL.

"Rare accidental visitor" (Gibbs' Birds of Michigan); "rare at Mackinac Island"

(S. E. White); "arctic regions south in winter to New York" (Jordan). I think this a doubtful Michigan species. Dr. Gibbs informs me that it is reported from Mackinac Island.

GENUS LARUS LINN.

16–42–(768). Larus glaucus *Brunn.* GLAUCOUS GULL; ICE GULL.

Rare; "Upper Peninsula and one taken at Klinger's Lake, St. Joseph county, 1892" (A. H. Boies); "Lake Michigan" (Butler's Birds of Ind.); Prof. Ludwig Kumlein reports taking several specimens at Milwaukee, Wis.; "south in winter to New York" (Jordan); embraced in the University list at Ann Arbor, and in the lists of Miles, Sager and Boies.

17–43–(769). Larus leucopterus *Faber.* ICELAND GULL; WHITE-WINGED GULL.

Rare; "Lake Michigan, winter" (Butler's Birds of Ind.); about all the great lakes; "rare on Lake Erie" (Jerome Trombley); "south to New York" (Jordan).

18–47–(771). Larus marinus *Linn.* GREAT BLACK-BACKED GULL.

"Kent county, March 28, 1889, and very rare migrant at Mackinac Island" (S. E. White); "winter visitant on Lake Michigan, Dr. Velie, Ridgway's list of birds of Illinois, 1874" (Gibbs's Birds of Michigan).

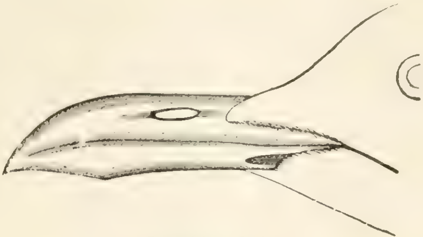
19–51a–(773). Larus argentatus smithsonianus *Coues.* AMERICAN HERRING GULL; SMITHSONIAN GULL.

Very abundant; throughout the state; migrant and winter resident; breeds; "nests abundantly on Isle Royal, Michigan" (Frank S. Daggett in O. and O., Vol. XV, p. 99); observed once in January when the river was free of ice, when several were seen on Saginaw Bay, common in spring, rarely seen in summer, but old and young are abundant in fall, formerly bred on Heisterman's and other islands on Saginaw Bay, possibly breeds now on Charity Islands" (N. A. Eddy); "common at St. Joseph in spring and autumn, many remaining through the winter. They are often seen in flocks. They follow the tugs for refuse, and are very common at Marquette" (O. B. Warren); "common in spring, summer and fall, and are seen occasionally in winter, nest abundantly on Thunder Bay Island, off Alpena" (W. A. Oldfield); "nests very extensively on hummocks on the ground at Gull Island, east of Escanaba" (L. W. Watkins) "breeds at Mackinac Island, and is common on the Grand river at Grand Rapids" (S. E. White); "common on Lake Erie" (Jerome Trombley); "Keweenaw Point" (Kneeland). This and Bonaparte's Gull are often seen as far inland as Lansing. They are common along all the great lakes. C. S. Osborn writes me that Gulls deposit barrels of eggs on the rocky islands of Georgian Bay. These eggs are gathered by thousands and eaten by fishermen, or used in manufacturing eggine or egg albumen. The number is simply marvelous. See interesting article by Frank S. Daggett in O. and O., Vol. XV, 1890, p. 99. It is stated that some of the very numerous nests at Isle Royale were on the unstable icebergs.

20–54–(778). Larus delawarensis *Ord.* RING-BILLED GULL.

Common throughout the state; migrant and winter resident; "not uncommon, migrant at St. Joseph" (O. B. Warren); A. H. Boies says this is a summer resident; "Kent county and common migrant at Mackinac Island" (S. E. White); "frequently seen in spring" (Jerome Trombley); "breeds in Northern Peninsula" (Prof. Ludwig

Kumlein); "breeds abundantly on Gull Island. in Lake Michigan. twenty-five miles southeast of Escanaba" (Ed. VanWinkle in Oölogist, Vol. X, p. 114); "all United States south to Mexico" (Jordan).



Laughing Gull.

21-58-(786). Larus atricilla *Linn.* LAUGHING GULL; BLACK-HEADED GULL.

"Very abundant on the Great Lakes, probably breeds in the Northern Peninsula" (Gibbs' Birds of Michigan); "one shot on the lake shore north of Port Sanilac" (W. A. Oldfield); very rare; "north if it occur at all" (Dr. A. K. Fisher); "fairly common" (Prof. Ludwig Kumlein); "common migrant on Lake Erie" (Jerome Trombley); "one killed in Washtenaw county in 1884" (L. W. Watkins). This species is given in Dr. Sager's list of 1839.

22-59-(787). Larus franklinii *Sw. and Rich.* FRANKLIN'S GULL.

"Not rare on Lake Michigan during winter and spring" (Gibbs' Birds of Michigan); "occasional migrant and rare winter visitor in Indiana" (Butler's Birds of Ind.); "chiefly west of the Mississippi" (Jordan).

23-60-(788). Larus philadelphia (*Ord.*). BONAPARTE'S GULL; BONAPARTE'S ROSY GULL.

Rather common in spring and fall; "throughout the state" (A. H. Boies); often seen inland; frequently killed at Lansing; "abundant on Saginaw Bay in fall, immense numbers are seen at times, old and young were seen August 8 and 9. 1889, on the Bay not far from Little Charity Islands, where, I am told, a few breed" (N. A. Eddy); taken in Oakland Co. by J. B. Purdy; "about our inland lakes" (Dr. W. C. Brownell); "rather rare in Kalamazoo county" (Dr. M. Gibbs); Dr. Gibbs is reported to have seen a flock on Mackinac Island; "occasionally seen at St. Joseph, in spring migrations" (O. B. Warren); found breeding on St. Clair flats, by W. H. Collins (Bull. Nutt. O. Club, Vol. V, p. 61); "occasionally in spring in Monroe county" (Jerome Trombley); "Keweenaw Point" (Kneeland); "breed near Escanaba" (Prof. Ludwig Kumlein); "occasionally seen in flocks on the lake at Port Sanilac in spring and summer" (W. A. Oldfield).

GENUS XEMA LEACH.

24-62-(790). Xema sabinii (*Sab.*). SABINE'S GULL; FORKED-TAILED GULL.

"Lake Michigan" (Butler's Birds of Ind.); "South to New York" (Jordan).

SUBFAMILY STERNINÆ. TERNS; SEA SWALLOWS.

GENUS GELOCHELIDON BREHM.

25 63-(792). **Gelochelidon nilotica** (*Hasselq.*). GULL-BILLED TERN; MARSH TERN

Rather common; "a straggler and rather rare in Kalamazoo county" (Dr. M. Gibbs); Great Lakes; often abundant on Lake Michigan; "often common on Lake Erie" (Jerome Trombley); "Ohio, Illinois and Michigan" (Butler's Birds of Indiana, p. 108); "breeds on St. Clair Flats" (A. B. Covert); R. H. Wolcott saw it at St. Clair Flats, July 20, 1893.

GENUS STERNA LINN.

26-64-(793). **Sterna tschegrava** *Lepech.* CASPIAN TERN; IMPERIAL TERN.

Very rare; probably a straggler; one taken by the late W. H. Collins of Detroit is now in the National Museum; Great Lakes. Seen by Robert H. Wolcott at St. Clair Flats, July 20, 1893; winter; "taken repeatedly at Mackinac Island, identification certain" (S. E. White); said to breed on islands of Lake Michigan (see Davie's Nests and Eggs of North American Birds, p. 33); breeds abundantly on Gull Island, twenty-five miles southeast of Escanaba. (Ed. VanWinkle in Oölogist, Vol. X, p. 114); nest in a slight hollow in the ground; eggs, two or three, dark drab or greenish buff, spotted with brown and lilac; Prof. Ludwig Kumlein has taken several sets of eggs at Green Bay, Wisconsin.

27-65-(794). **Sterna maxima** *Bodd.* ROYAL TERN; CAYENNE TERN.

Rare; spring and summer; Lake Michigan; "rare summer visitant, occasionally taken on Lake Michigan in late spring" (Gibbs' Birds of Michigan); "common but less so than the preceding at Mackinac Island" (S. E. White); "Upper Peninsula" (A. H. Boies); see Butler's Birds of Indiana, p. 108.

28-69-(798). **Sterna forsteri** *Nutt.* FORSTER'S TERN.

Not common; spring, summer and autumn; "Hillsdale county" (A. H. Boies); "breeds on St. Clair Flats" (A. B. Covert); "quite common at Port Sanilac, and breeds at St. Clair Flats, where I have taken eggs" (W. A. Oldfield); "breeds freely in Upper Peninsula" (Prof. Ludwig Kumlein); "breeds on shore of Lake Superior" (H. Nehrling).

29-70 (797). **Sterna hirundo** *Linn.* COMMON TERN; WILSON'S TERN; SEA SWALLOW.

Common; migrant; "common on Saginaw Bay in fall, a few breed on Heisterman's Island, nesting on top of the muskrats' houses in marshes" (N. A. Eddy); "common on Lake Erie" (Jerome Trombley); seen at St. Clair Flats, July 20, by Robt. H. Wolcott; "rather common migrant at St. Joseph" (O. B. Warren); "breeds on St. Clair Flats" (A. B. Covert); "throughout the summer in northern Indiana, where it may breed" (Butler's Birds of Indiana); T. G. White saw a specimen on Mackinac Island, August 28, 1890; "Keweenaw Point" (Kneeland); "breeds in Upper Peninsula" (Prof. Ludwig Kumlein); nests on ground; eggs four, very variable, often pinkish drab, spotted with brown or gray; nests rude. This bird is embraced in Dr. A. Sager's list of 1839.

30-71-(799). Sterna paradisæa *Brunn.* ARCTIC TERN.

"Not a common migrant" (Gibbs' Birds of Michigan); "south to New York" (Jordan); "sometimes breeds at Lake Koshkonong, Wis." (Prof. Ludwig Kumlein).

Roseate Tern.

31-72-(800). Sterna dougalli *Montag.* ROSEATE TERN.

Rare; probably a straggler; Lake Michigan; "occasional visitor" (Gibbs' Birds of Michigan); one specimen recorded in catalogue of the Birds of Michigan in the museum of Kent Scientific Institute at Grand Rapids, by E. L. Moseley; Prof. Smith shot two from a flock of five, in Hillsdale, in the spring of 1892" (F. M. Falkner); "common on Lake Erie and Raisin River" (Jerome Trombley); "probable summer resident" (Dr. J. B. Steere).

32-74-(801). Sterna antillarum *Less.* LEAST TERN.

Given in Gibbs' Birds of Michigan; O. B. Warren tells me there is one in Albion College museum, taken near Albion; "reported as a summer resident in Norther Indiana" (Butler's Birds of Indiana); "have a set of eggs taken on Mitchell's Bay, Lake St. Clair" (W. A. Oldfield); "certainly breeds at St. Clair Flats" (Dr. W. C. Brownell).

33-75-(804). Sterna fuliginosa *Gmel.* SOOTY TERN.

Dr. G. W. Topping of DeWitt, is authority for one having been taken near DeWitt in the spring of 1880. Coues says "along the Atlantic coast;" Ridgway says "north to Carolinas, casually to New England;" if taken in Michigan its occurrence was doubtless a rare accident.

GENUS HYDROCHELIDON BOIE.

34-77-(306). Hydrochelidon nigra surinamensis *Gmel.* BLACK TERN; SHORT-TAILED TERN.

Abundant; spring and summer; "Hillsdale Co." (A. H. Boies); "have shot them as they flew over at Port Sanilac" (W. A. Oldfield); "Mackinac Island" where several were seen by Dr. M. Gibbs (S. E. White); taken at St. Clair Flats by W. H. Collins (Bull. Nutt. O. Club, Vol. V, p. 61); "rare at Bay City, probably breeds however, in the surrounding marshes. Observed at Heisterman's Island and at St. Clair Flats" (N. A. Eddy); "common on Lake Erie and Raisin River" (Jerome Trombley); "nests on floating debris at St. Clair Flats" (W. A. Davidson); Robt. H. Wolcott found a nest with three eggs at St. Clair Flats, July 20, 1893; "common at Saginaw" (Miles' Birds of Michigan); "Kent Co." (S. E. White); breeds; "abundant breeder in Wayne Co." (B. H. Swales); "probably raises two broods" (Amos W. Butler; nests about lakes in June on hummocks on the ground, often built up several inches; eggs three, greenish, "and spotted" (Gibbs).

ORDER STEGANOPODES. TOTIPALMATE SWIMMERS.

FAMILY ANHINGIDÆ. THE ANHINGAS.

Long, slim birds.

GENUS ANHINGA BRISS.

35-118-(760). Anhinga anhinga (*Linn*). ANHINGA, DARTER, SNAKE BIRD, WATER TURKEY.

I place this bird in the list on authority of Mr. Charles Drury, who says that there is a specimen in a collection in Cincinnati that was taken at Sault Ste. Marie.

FAMILY PHALACROCORACIDÆ. CORMORANTS.

Heavy hooked-billed birds; food, fish; they do not plunge, but dive for their food.

GENUS PHALACROCORAX BRISS.

36-119-(750). Phalacrocorax carbo (*Linn.*), CORMORANT.

"An occasional visitor" (Gibbs' Birds of Michigan); of doubtful occurrence in Michigan.

37-120 (751). Phalacrocorax dilophus (*Sw. and Rich.*). DOUBLE-CRESTED CORMORANT.

"Common at times" (Dr. M. Gibbs); migrant or winter resident" "Southern Michigan, Hillsdale County" (A. H. Boies); "our commonest species" (Jordan); "breeds in great numbers in Wisconsin" (Davie's Nests and Eggs of North American Birds). Dr. Ezra S. Holmes, of Grand Rapids, has a fine male which he took in Northern Indiana, just over the Michigan line, and Mr. Levi Broas took a fine female near Ionia, which is now in our museum; one was shot at Pine Lake, August 1893, and is in the collection of Mr. C. J. Davis of Lansing.

FAMILY PELECANIDÆ. PELICANS.

Heavy birds with long, hooked beaks; large pouch beneath the lower jaw; food, fish; either plunge for or scoop up their food.

GENUS PELECANUS LINN.

38-125-(748). Pelecanus erythrorhynchos *Gmel.* AMERICAN WHITE PELICAN.

Very rare; "Hillsdale and Lenawee Co's." (A. H. Boies); "one killed on Saginaw Bay, one in St. Joseph Co., and it has been seen in the Upper Peninsula" (Dr. M.

Gibbs); one killed in Allegan Co. (O. and O., Vol. XVII, 1892, p. 143); one in museum from Berrien Co.; "one taken at Tecumseh, Lenawee Co., in 1882" (L. W. Watkins); "two killed in a flock of forty or fifty, at Cambria, Mich., and now mounted in a store in Hillsdale" (F. M. Falconer); "Keweenaw Point" (Kneeland).

Order ANSERES. Lamellirostral Swimmers.

Family ANATIDÆ. Ducks, Geese and Swans.

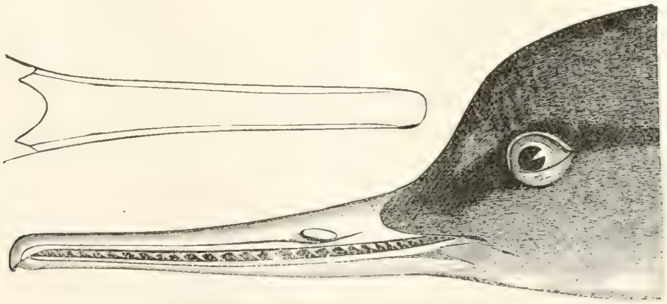
Birds with thick feathers, lamellate bills, palmate feet; food, mostly vegetable; some insects, etc.

Subfamily MERGINÆ. Mergansers.

Genus MERGANSER Briss.

39-129-(743). Merganser americanus (*Cass.*). American Merganser; Merganser; Goosander; Fish Duck.

Common; "throughout the state" (A. H. Boies); migrant or winter resident; reported from St. Clair Flats; "have seen acres of water covered by them in spring" (Dr. W. C. Brownell); "occasionally see one or two on the lake at Port Sanilac" (W. A. Oldfield); "common at St. Joseph" (O. B. Warren); "Kent Co. and summer resident at Mackinac Island" (S. E. White); "common at Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); "common migrant on Lake Erie" (Jerome Trombley); included in Dr. Sager's list of 1839; occasionally a summer resident, especially in the northern part of this state, where it may breed. This fine bird is very common at Saginaw Bay and about all the lakes in spring and fall; it is not fit for table use; "tolerably common at Heisterman's Island, Saginaw Bay, in the fall where I started an old bird with brood, June 4, 1888, as I did not take her, I may be mistaken in identification" (N. A. Eddy).



Red-breasted Merganser, natural size.

40-130-(744). Merganser serrator (*Linn.*). Red-breasted Merganser.

Rare; migrant; winter resident; often in large flocks; we have it from Saginaw Bay; taken at Plymouth by J. B. Purdy; "common on Saginaw Bay" (N. A. Eddy); A. A. Boies reports it from St. Joseph Co.; "common migrant on Lake Erie" (Jerome

Trombley); "Keweenaw Point" (Kneeland); "breeds in Northern Peninsula" (Prof. Ludwig Kumlein); Mr. S. E. White took nine eggs from a nest on Round Island, near Mackinac Island, the nest was near the water's edge under a low cedar. Dr. A. K. Fisher thinks it doubtful if it breeds in Michigan. This Merganser is given in Sager's list of 1839.

GENUS LOPHODYTES REICH.

41-131-(745). Lophodytes cucullatus (*Linn.*) *HOODED MERGANSER; SAW-BILL; TOP-KNOT.

Very abundant; "throughout the state" (A. H. Boies); migrant; "Kent Co. and Mackinac Island" (S. E. White); "common at St. Joseph" (O. B. Warren); "occasionally shot along the shore by Port Sanilac. I have taken two males" (W. A. Oldfield); "I found this species tolerably common on Heisterman's Island, October, 1888" (N. A. Eddy); "common at Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); "common migrant on Lake Erie" (Jerome Trombley); taken at Plymouth by J, B. Purdy; taken frequently at Pine Lake; in April and September; may breed as it is occasionally taken in summer; "doubtless breeds, eggs usually ten to twelve, may range from six to eighteen" (Amos W. Butler); said to nest in hollow trees; "feeds on snails and crabs, excellent table duck" (J. H. Whitehead); "flesh almost as rank as that of the two preceding" (Ludwig Kumlein); this is one of our handsomest ducks. In California this duck is not noticed by hunters. as it has no value in the market.

GENUS ANAS LINN.

42-132-(707). Anas boschas *Linn.* *MALLARD; MALLARD DUCK; GREEN HEAD.

Very abundant; throughout the entire state; summer months, though usually a migrant; March, April, September and October; reported common in Kalamazoo and Wayne counties; "abundant in Monroe Co." (Jerome Trombley); "abundant throughout the state" (A. H. Boies); "common, breeds, a pair or so breed each year at Heisterman's Island, Saginaw Bay. The female of this species and both sexes of the next are all known as gray ducks" (N. A. Eddy); "flocks often seen in the lake and creeks at Port Sanilac, but it does not breed here" (W. A. Oldfield); "nests by thousands at St. Clair Flats" (Dr. W. C. Brownell); "common migrant at Albion and St. Joseph, where only a few remain now to breed owing to persecution by hunters" (O. B. Warren); "very common in Kent Co. and rather rare migrant at Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); breeds; nests on the ground; Dr. Gibbs reports a nest in a hollow tree; nest elaborate; eggs six to twelve, color dirty white to olive green; excellent game bird. Our domestic ducks come largely from this species.

43-133-(708). Anas obscura *Gmel.* BLACK DUCK; DUSKY DUCK.

Common in fall and spring; occasional in fall and summer; "migrant and occasional summer resident in Northern Indiana" (Butler's Birds of Indiana); "throughout the entire state" (A. H. Boies); "common migrant at Albion. St. Joseph, and Palmer, Marquette Co." (O. B. Warren); "Keweenaw Point" (Kneeland); reported from Bois Blanc Island; "Monroe Co." (Jerome Trombley); "undoubtedly breeds" (Dr. M. Gibbs); "Mr. W. A. Davidson took a nest at St. Clair Flats" (Dr. W. C. Brownell);

"occasionally seen in flocks at Port Sanilac, in spring and fall. I took one set of six eggs at St. Clair Flats" (W. A. Oldfield); Dr. J. B. Steere gives it as a questionable summer resident; Prof. Ludwig Kumlein writes me that this duck breeds in Northern Wisconsin, and without doubt in our Northern Peninsula. "Common in fall, without doubt breeds, as I have seen a pair in our marshes in the breeding season which I am confident had a nest" (N. A. Eddy).

44–135–(711). Anas strepera *Linn.* *GADWALL.

"Common throughout the entire state" (A. H. Boies); "common migrant at Albion, but only occasional at St. Joseph" (O. B. Warren) "occasionally one shot in winter at Port Sanilac" (W. A. Oldfield); April and October; migrant; "breeds in the Northern Peninsula" (Prof. Ludwig Kumlein); "Keweenaw Point" (Kneeland); often taken at Park and Pine lakes, near Lansing; Dr. J. B. Steere gives it as a summer resident with a question mark; included in Sager's list of 1839.

45–137–(713). Anas americana *Gmel.* BALDPATE; AMERICAN WIDGEON.

Common; migrant; April, May and October; "common in Monroe county, but not known to breed" (Jerome Trombley); "quite common in spring, summer and fall at Port Sanilac" (W. A. Oldfield); "migrant at Albion and St. Joseph" (O. B. Warren); reported common at St. Clair Flats; "common in Kent Co." (S. E. White); Dr. J. B. Steere gives it as a doubtful summer resident; "rare summer resident in Northern Indiana, where it breeds" (Butler's Birds of Indiana); "Keweenaw Point" (Kneeland); we have fine specimens in our museum taken at Pine lake. This species is included in Dr. A. Sager's list of 1839.

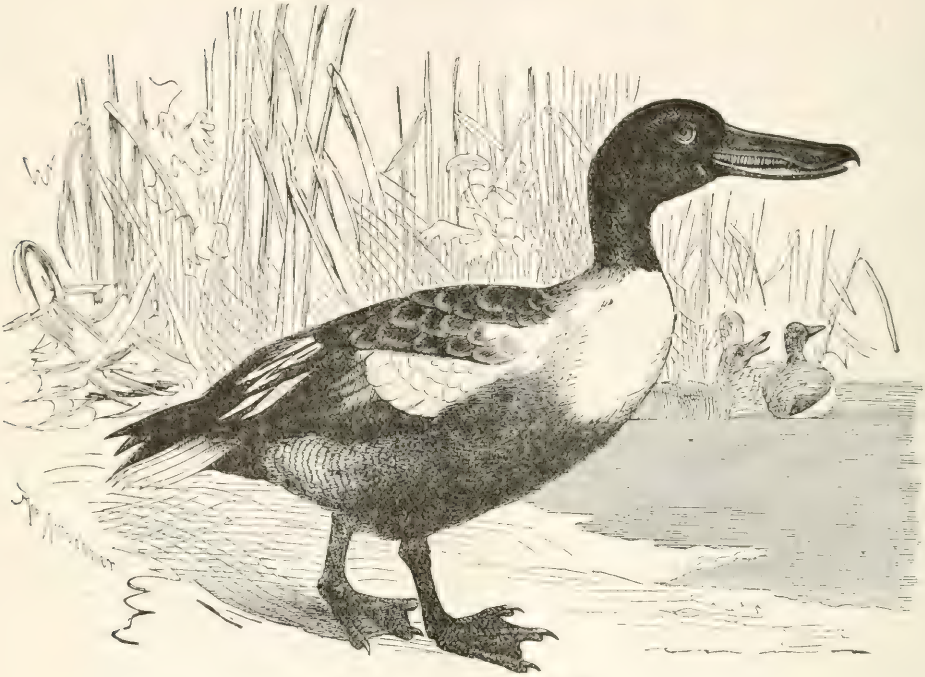
46–139–(715). Anas carolinensis *Gmel.* GREEN-WINGED TEAL.

Common; "throughout the state" (A. H. Boies); migrant; May and October; taken at Pine lake near the college; this and the four succeeding species all taken at Plymouth by J. B. Purdy; "quite common in spring, summer and fall at Port Sanilac and breeds on St. Clair Flats" (W. A. Oldfield); "Keweenaw Point" (Kneeland); "migrant in Monroe Co." (Jerome Trombley); "breeds at St. Clair Flats" (Dr. W. C. Brownell); "rare migrant at Albion, but common at St. Joseph, where it occasionally breeds" (O. B. Warren); one of our best table ducks; "tolerably common on Saginaw Bay" (N. A. Eddy).

47–140–(716). Anas discors *Linn.* BLUE-WINGED TEAL.

Very common; "throughout the state" (A. H. Boies); April and October; usually a migrant; "summer resident" (Dr. J. B. Steere); "common in spring, abundant in fall, no doubt but what it breeds" (N. A. Eddy); "quite common at Port Sanilac in spring, summer and fall. I have taken eggs at St. Clair Flats" (W. A. Oldfield); "two nests found and eggs taken by S. E. White in Allegan Co., May 28, 1891; "found breeding at the mouth of Kalamazoo river" (Dr. M. Gibbs); "common at Albion, and very common at St. Joseph, where it breeds" (O. B. Warren); "occasionally breeds in Monroe Co." (Jerome Trombley); "surely breeds at St. Clair Flats" (Dr. W. C. Brownell); "breeds at Sault Ste. Marie" (C. S. Osborn); "Keweenaw Point" (Kneeland); nests on ground, in swamp grass; eggs twelve. Mr. J. B. Purdy writes me that he has frequently taken the young, some of which were yet unable to fly, at Plymouth.

GENUS SPATULA BOIE.

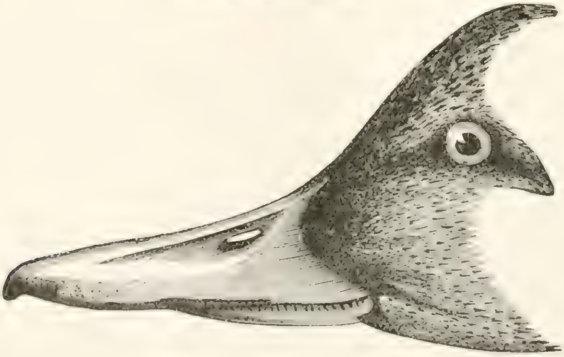


Shoveler, one-fourth natural size.

48-142-(718). Spatula clypeata (*Linn.*). SHOVELER; SPOON-BILL.

Very common migrant; "breeds in the Northern Peninsula" (Prof. L. Kumlein); bill very broad; lamellæ of bill very marked; taken frequently at Pine lake, near here, in April and May; Dr. Steere gives it as a questionable summer resident; "probably breeds in Northern Indiana" (Amos W. Butler); "St. Joseph and Monroe counties" (A. H. Boies); "common on Lake Erie" (Jerome Trombley); "common migrant at Albion and St. Joseph" (O. B. Warren); "Keweenaw Point" (Kneeland); in Sager's list of 1839.

GENUS DAFILA STEPH.



Pintail, female, natural size.

49-143-(710). Dafila acuta (*Linn.*). PINTAIL; SPRIGTAIL.

Rather common; "throughout the state" (A. H. Boies); "Keweenaw Point" (Kneeland); migrant and possibly winter resident; September and May; "Monroe Co." (Jerome Trombley); "never saw it in January" (Dr. M. Gibbs); "have shot many of these in the fall at Port Sanilac" (W. A. Oldfield); "tolerably common in spring and fall on Saginaw Bay" (N. A. Eddy); reported common at St. Clair Flats; "migrant" (Dr. J. B. Steere); "doubtful winter resident" (Amos W. Butler); embraced in Sager's list of 1839.

GENUS AIX BOIE.

Wood Duck, reduced.

50-144-(719). Aix sponsa (*Linn.*) *WOOD DUCK; SUMMER DUCK; TREE DUCK.

Very common; "throughout the entire state" (A. H. Boies); I have it authentically reported from Kent, Monroe, Washtenaw, St. Clair and Muskegon counties and Mackinac Island; "abundant summer resident, found breeding at Heisterman's Island," Saginaw Bay (N. A. Eddy); "breeds abundantly in this county—Sanilac—on Black River" (W. A. Oldfield); "rare at Albion, but formerly very common, summer resident at St. Joseph" (O. B. Warren); "common at Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); summer resident; March, rarely February; to November; "once common but now rare in Monroe Co." (Jerome Trombley); S. E. White reports a male seen at Mackinac Island July 11, 1889; breeds abundantly; nests in the tops or hollows of trees, hence called tree duck; eggs, dirty yellowish white; one of our handsomest ducks; an excellent game bird; the males sometimes feed in flocks during the breeding season" (S. E. White). This beautiful bird was once very common on the Red Cedar, which passes by our college campus, where I have often taken it from April to October. Unfortunately these birds, formerly so common, are being rapidly thinned by hunters.

GENUS AYTHYA BOIE.

51-146-(723). Aythya americana (*Eyt.*). REDHEAD; AMERICAN POCHARD.

Quite common; "throughout the entire state" (A. H. Boies); spring and fall; migrant; "common on Lake Erie" (Jerome Trombley; "have shot it on the lake here at Port Sanilac in fall, it does not breed here" (W. A. Oldfield); rare at Albion" (O. B. Warren); "abundant spring and fall, migrant" (N. A. Eddy); "Keweenaw Point" (Kneeland); I also have reports from Kent and St. Clair counties; taken at Plymouth by J. B. Purdy; this is frequently taken at Pine lake, near here, in October; found breeding at St. Clair Flats by W. H. Collins (Bull. Nutt. O. Club, Vol. V, p. 61). Davie, p. 58, mentions it as breeding in Michigan; included in Sager's list of 1839.

52–147–(724). Aythya vallisneria (*Wils.*). CANVAS-BACK.

Not very common; taken on Detroit river by J. B. Purdy, migrant; more abundant near the Great Lakes; "have known two shot at Port Sanilac, and think it passes in spring and fall" (W. A. Oldfield); "common on Lake Erie" (Jerome Trombley); "sportsmen report taking it occasionally on Saginaw Bay, but I have never seen it in this locality. It is reported to me as tolerably common on St. Clair Flats" (N. A. Eddy); "common at St. Clair Flats" (Dr. W. C. Brownell); "not found on inland lakes, but rarely taken at St. Clair Flats and Saginaw Bay" (A. H. Whitehead); "Keweenaw Point" (Kneeland); "common where wild celery abounds, rare at Sault Ste. Marie" (C. S. Osborn); perhaps our finest game duck.

53–148–(720). Aythya marila nearctica *Stejn.* AMERICAN SCAUP DUCK; GREATER SCAUP DUCK; GREATER BLUE-BILL; GREATER BLACKHEAD.

Common; "migrant at Ann Arbor" (Dr. J. B. Steere); fall and spring, often very common in fall; migrant; "abundant in spring and fall migrations at Saginaw Bay" (N. A. Eddy); "quite common in the lake at Port Sanilac in fall. I have taken several" (W. A. Oldfield); one nest reported by W. H. Collins from St. Clair Flats. (Bull. Nutt. O. Club, Vol. V, p. 61); "common on Lake Erie" (Jerome Trombley); "Keweenaw Point" (Kneeland); "Mr. Love Dockery collected two sets of their eggs on the rocky islands near Isle Royale, June, 1893," (E. W. Durfee); taken at Plymouth by J. B. Purdy; we find it very common at Pine Lake in October; "common game duck" (Dr. W. C. Brownell).

54–149–(721). Aythya affinis (*Eyt.*). LESSER SCAUP DUCK; LESSER BLUE-BILL; LESSER BLACKHEAD.

Very abundant; migrant; taken plentifully at Pine Lake, five miles east of the college, in October and November; "common in Detroit markets" (Dr. W. C. Brownell); "very common migrant at Albion and St. Joseph" (O. B. Warren); "abundant spring and fall migrant at Saginaw Bay, one of our most common ducks at these times. I have taken them September 1. I think a few breed" (N. A. Eddy); "common at Iron Mountain" (E. E. Brewster); "migrant at Ann Arbor" (Dr. J. B. Steere); "common on Lake Erie" (Jerome Trombley); one nest reported by W. H. Collins at St. Clair Flats. (Bull. Nutt. O. Club, Vol. V, p. 61); it very likely breeds here sparingly, north abundantly; "This is a good game bird and decoys very easily" (S. E. White).

55–149 (722). Aythya collaris (*Donov.*). RING-NECKED DUCK; BLACKHEAD.

Rather common; "throughout the state during migration" (A. H. Boies); taken at Plymouth by J. B. Purdy; "Iron Mountain, April 18, 1889" (E. E. Brewster); migrant; March and September; Davie, p. 70, says it breeds from New York to Wisconsin, and north; not rare at Pine Lake in October and November; given in Dr. A. Sager's list of 1839; "tolerably common in Northern Indiana" (Butler's Birds of Indiana).

GENUS GLAUCIONETTA STEJN.

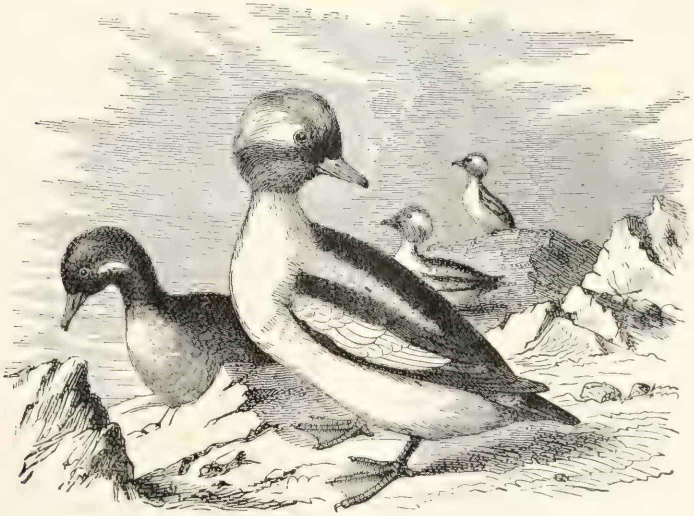
56-151-(725). Glaucionetta clangula americana (*Bonap.*). AMERICAN GOLDEN-EYE; GOLDEN-EYE; WHISTLER; GARROT.

"Common from the north, late in November, and often remains all winter on open spots of swift running rivers, dives at the flash of a gun, and will escape shot at thirty feet to my certain knowledge" (Dr. M. Gibbs); "rather common migrant at Albion" (O. B. Warren); "occasionally seen in Black River, six miles west of Port Sanilac in fall and open winters" (W. A. Oldfield); "throughout the state" (A. H. Boies); reported from Kent Co.; migrant; "Dr. Brayton gives this as a winter resident on Lake Michigan" (Amos W. Butler); "common in early spring and late fall on Saginaw Bay" (N. A. Eddy); "winter resident on Lake Michigan and open inland lakes" (Prof. Ludwig Kumlein); "Keweenaw Point" (Kneeland); "common on the rapids of the St. Mary's river all winter" (C. S. Osborn) "this bird is taken at Pine Lake, is a fine game duck and is so quick to dive that it is difficult to shoot it on the water" (A. H. Whitehead). There are several of these ducks in the collection of Mr. Levi Broas, of Belding, Mich., taken by him in that locality. I think this a common species all through the Southern Peninsula.

57-152-(726) Glaucionetta islandica (*Gmel.*). BARROW'S GOLDEN-EYE.

Brayton in his "Birds of Indiana" gives this as a winter resident of Lake Michigan; "one taken at Hillsdale from a flock on the lake in 1892" (F. M. Falconer); "only taken on Lake Michigan as a rare straggler" (Ludwig Kumlein); "not uncommon winter resident on Lake Michigan" (H. Nehrling); embraced by Stockwell in his list of Michigan birds (F. and S., Vol. VIII, pp. 23, 380); "abundant at Saginaw Bay in spring and fall. While the other ducks take to the open lake during the middle of the day, this species remains more in or near by the marshes" (N. A. Eddy).

GENUS CHARITONETTA STEJN.



Buffle-head, much reduced.

58 153-(727). Charitonetta albeola (*Linn.*). *BUFFLE-HEAD; BUTTER-BALL; SPIRIT DUCK.

Very abundant; small flocks; "throughout the state" (A. H. Boies); spring and fall; winter resident; occasional in summer; "probably breeds at St. Clair Flats" (Dr. W. C. Brownell); "quite common at Port Sanilac, where I have taken them in winter" (W. A. Oldfield); reported from Kent and St. Clair Co's; "common on Lake Erie" (Jerome Trombley); "common migrants at Albion and St. Joseph" (O. B. Warren); "not rare at Traverse City" (Dr. M. L. Leach); S. E. White saw a flock of eight at Mackinac Island, July 3, 1890, and O. B. Warren reports it common at Palmer, Marquette Co.; "common at Iron Mountain" (E. E. Brewster;) "Keweenaw Point" (Kneeland); taken by Dr. Atkins in April and July; we have taken several at Pine Lake in November. This duck is rapid of flight and quick to dive.

GENUS CLANGULA LEACH.

59 154-(728). Clanguls hyemalis (*Linn.*). OLD SQUAW; OLD WIFE; LONG-TAILED DUCK.

Winter resident; more abundant near Great Lakes; one specimen taken near here at Pine Lake; reported from Kent Co.; "I took one in February and one in June, 1893, at Port Sanilac" (W. A. Oldfield); occasionally common in Kalamazoo Co.—"A flock noted Feb., 1884" (Dr. M. Gibbs); "two specimens taken in Grand Traverse Co." (Dr. M. L. Leach); "St. Joseph Co." (A. H. Boies); "common migrant on Lake Erie" (Jerome Trombley); "abundant on Lake Michigan" (Butler's Birds of Indiana).

GENUS HISTRIONICUS LESS.

60-155-(730). Histrionicus histrionicus (*Linn.*). HARLEQUIN DUCK.

Very rare; admitted in Gibbs' Birds of Michigan. A. H. Boies thinks this should be included. Prof. Ludwig Kumlein writes me that he has taken two specimens in Jefferson Co., Wisconsin.

GENUS SOMATERIA LEACH.

61-160-(734). Somateria dresseri *Sharpe.* AMERICAN EIDER.

"Occasionally seen on Lake Superior" (Gibbs' Birds of Michigan); the late W. H. Collins reported taking a young male in Detroit on Detroit River, Dec., 1882. If this bird occurs in Michigan it must be as an accidental straggler.

62-162-(736). Somateria spectabilis (*Linn.*). KING EIDER.

"Straggler taken at Milwaukee and Grand Haven, Michigan" Prof. Ludwig Kumlein). Dr. A. K. Fisher thinks this very doubtful.

GENUS OIDEMIA FLEM.

63-163-(737). Oidemia americana *Sw. and Rich.* AMERICAN SCOTER; AMERICAN BLACK SCOTER.

"Rare accidental visitor" (Gibbs' Birds of Michigan); "a single female purchased in Bay City market, Oct. 20, 1883" (N. A. Eddy); "not uncommon in winter on Lake Michigan" (H. Nehrling and L. Kumlein).

64-165-(738). Oidemia deglandi *Bonap.* WHITE WINGED SCOTER; VELVET SCOTER.

Rather rare; migrant; two in our museum taken at Pine Lake, near here, in 1885; "a flock of six at Heisterman's Island, Saginaw Bay, October 29, 1888, one from same place in female plumage, October 15, 1889, and a male in city market, November 10, 1892" (N. A. Eddy); "Lake Michigan" (Butler's Birds of Indiana); "This bird is becoming more numerous, now frequently taken during migration at Park and Pine Lakes near Lansing" (C. J. Davis); "occurs regularly on Lake Michigan" (Prof. Ludwig Kumlein); "cannot be called common in Upper Peninsula" (C. S. Osborn).

65-166-(739). Oidemia perspicillata *Linn.* SURF DUCK; SURF SCOTER; SEA COOT.

Very rare; winter visitor; one specimen taken in 1884 at mouth of Saginaw River. I find it often quite common in fall migrations. It is frequently taken by the duck hunter, who calls it the "Booby Duck." "They regard it as unfit to eat, but when taken in fresh water it is excellent eating" (N. A. Eddy); "regular migrant on inland lakes of Wisconsin" (Prof. Ludwig Kumlein); "not uncommon on Lake Michigan" (H. Nehrling); "taken near Iron Mountain, October 20, 1890" (E. E. Brewster).

GENUS ERISMATURA BONAP.

66-167-(741). Erismatura rubida (*Wils.*). RUDDY DUCK; BLACK JACK.

Exceedingly abundant; "throughout the state" (A. H. Boies); migrant; April, October and November; very common at Pine Lake; taken in Oakland County by J. B. Purdy; reported from Kent Co.; "occasionally taken on Saginaw Bay, I have taken it at Heisterman's Island" (N. A. Eddy); "quite common in spring and fall at Port Sanilac" (W. A. Oldfield); "exceedingly abundant some falls in Kalamazoo County" (Dr. M. Gibbs); "abundant migrant at Albion and St. Joseph" (O. B. Warren); "common migrant on Lake Erie" (Jerome Trombley); Mr. Jerome Trombley reports large numbers on Raisin River in spring of 1888; "at Mackinac Island, where one was killed September 3, 1890" (S. E. White); given by Dr. J. B. Steere as a summer resident; flocks; very fearless and stupid; "breeds in Northern Peninsula" (Prof. Ludwig Kumlein); the late W. H. Collins reported taking eggs; "not very good eating" (A. H. Whitehead).

GENUS CHEN BOIE.

67-169-(696). Chen hyperborea (*Pall.*). LESSER SNOW GOOSE.

Rare; migrant; reported from Michigan in the catalogue of the museum of the Kent scientific Institute, by E. L. Moseley; "a single individual seen on Saginaw Bay with a flock of Canada Geese" (N. A. Eddy); included in Butler's Birds of Indiana; "accidental if in Michigan" (Prof. Ludwig Kumlein); "northern counties of Indiana" (Butler's Birds of Indiana). It is possible that the next is often mistaken for this one.

68-169a-(695). Chen hyperborea nivalis (*Forst.*). GREATER SNOW GOOSE.

Common; March, October and November; throughout the state; migrant; Mr. A. H. Boies has seen large flocks flying in Hillsdale and Lenawee counties during winter; Dr. M. Gibbs reports taking three from a flock of ten or more October 24, 1884; "Keweenaw Point" (Kneeland); doubtfully given as a Michigan migrant by Dr. J. B. Steere; known to alight not infrequently near Lansing; excellent table bird. Hon.

Bela Hubbard (Memorials of a Half Century, p. 283) tells of two joining a flock of tame geese at the west end of Lake Erie where they remained two weeks till shot.

69–169.1–(694). Chen cærulescens (*Linn.*). BLUE GOOSE.

One specimen reported in Kent Scientific Institute at Grand Rapids by E. L. Moseley; "a single male bird in my collection purchased October 30, 1885 in Bay City market from a dozen killed by night on small lake north of Bay City" (N. A. Eddy); two captured from a flock on St. Clair Flats by the late W. H. Collins; "regular migrant throughout Wisconsin" (Prof. Ludwig Kumlein); "Indiana" (Butler's Birds of Indiana).

GENUS ANSER BRISS.

70–171a–(693). Anser albifrons gambeli (*Hartl.*). *AMERICAN WHITE-FRONTED GOOSE.

"Transient, rare" (Dr. M. Gibbs); "migrant" (Dr. J. B. Steere); "Keweenaw Point" (Kneeland); "Indiana, rare migrant" (Butler's Birds of Indiana). This is unquestionably very rare in Michigan.

GENUS BRANTA SCOP.

Canada Goose, reduced.

71–172–(702). Branta canadensis (*Linn.*). *CANADA GOOSE; COMMON WILD GOOSE.

Common; February to April, and September even to December; throughout the entire state; often seen flying over in March and November, and occasionally much earlier and later in large flocks, which are usually arranged in quite definite V-shaped figures; more commonly seen early or late in the day, and heard at all times of night; frequently alights; "abundant fall and spring migrant, occasionally alighting in the Saginaw marshes" (N. A. Eddy); "common in winter at Port Sanilac" (W. A. Oldfield); "often in wheat fields" (Jerome Trombley); common migrant at St. Joseph and Palmer, Marquette County, and very common at Albion, where it often tarries two or three days in early spring" (O. B. Warren); "Keweenaw Point" (Kneeland); nests on the ground; eggs, five to six, yellowish green "not distinguishable from those of our common geese" (Dr. W. C. Brownell). These birds are very shy and so are rarely taken. "Mr. Briggs of Wayne County has a fine pair. They attempt to migrate each season, which he prevents. They breed well in confinement. They cross readily with common geese, but the hybrids are infertile" (Dr. W. C. Brownell); "will sometimes swim up to ducking stools, and fly low in foggy weather" (L. S. Foster).

72-172a (704). Branta canadensis hutchinsii (*Sw. and Rich.*). HUTCHINS' GOOSE.

Rare migrant; reported in catalogue of birds of Michigan in the Kent Scientific Institute by E. L. Moseley; taken by the late W. H. Collins on St. Clair Flats. Amos W. Butler gives it as a rare migrant in Indiana; and, upon Dr. Brayton's authority, says it formerly bred in that state (Birds of Indiana, p. 25).

73-172b (702a). Branta canadensis occidentalis (*Baird*). WHITE-CHEEKED GOOSE.

Reported by the late W. H. Collins, who was a very accurate observer. Dr. A. K. Fisher thinks this doubtful.

74-172c (703). Branta canadensis minima *Ridgw.* CACKLING GOOSE.

Reported by the late W. H. Collins.

75-173-(700). Branta bernicla (*Linn.*). BRANT.

Rare or accidental; "common wild goose in the Upper Peninsula" (A. H. Boies); "one taken by E. M. Griffin in the winter of 1884, and now in the college museum at that place" (O. B. Warren); reported from Michigan by Robert B. Lawrence (Forest and Stream, Vol. XXXII, p. 316); migrant; this species while more common near the ocean, is said to occur not rarely in Michigan and the surrounding states; "I have often seen them" (Dr. W. C. Brownell); "Indiana" (Butler's Birds of Indiana); good game bird.

GENUS OLOR WAGLER.

76-180 (689). Olor columbianus (*Ord*). *WHISTLING SWAN; AMERICAN SWAN.

Rare, migrant; formerly very common on Lake Erie (Hubbard in Memorials of a Half Century, p. 283); occasional in summer; one in museum taken at Maple Rapids; one taken at Plymouth by J. B. Purdy; "one in museum of Albion College, shot near Albion in the spring of 1891, and a rare migrant at Palmer. Marquette Co." (O. B. Warren); one killed at Mason, this county, Nov. 28, 1878; "have known several to be shot about our inland lakes" (Dr. W. C. Brownell); one taken by Mr. Levi Broas near Ionia and now in his fine collection; two taken by E. A. Lockwood in the month of December at South Haven (Am. Field, Vol. XXVII); they occasionally occur in flocks in Jackson and Washtenaw Co's, where they have been taken repeatedly. "They are very shy and remain near large inland lakes" (L. W. Watkins); "not infrequently seen in Lenawee and Hillsdale Co's" (A. H. Boies); "occasionally shot by hunters on Lake Erie" (Jerome Trombley); "Keweenaw Point" (Kneeland); embraced in Dr. A. Sager's list of 1839; "an adult specimen in very much worn and faded plumage, evidently an old and enfeebled bird, taken among some ducks at Tobico marshes on Saginaw Bay, April 19, 1890" (N. A. Eddy).

77-181-(688). Olor buccinator (*Rich.*). TRUMPETER SWAN.

Rare; migrant; "Hillsdale Co." (A. H. Boies); one taken in Kent Co. by E. S. Holmes and now in his collection at Grand Rapids; included in the lists of Michigan birds by Covert, Fox, Stockwell, and Steere; counties of Northern Indiana (Butler's Birds of Indiana).

ORDER HERODIONES. HERONS, STORKS, IBISES, ETC.

SUBORDER IBIDES. SPOON-BILLS AND IBISES.

FAMILY IBIDIDÆ. IBISES.

Long bills; rather short legged waders: food, fish and other aquatic animals.

GENUS PLEGADIS KAUP.

78-186-(649). Plegadis autumnalis (*Hasselq.*). GLOSSY IBIS.

Very rare; occasional straggler; one Michigan specimen reported in the catalogue of the Kent Scientific Institute by E. L. Moseley; "killed Oct. 6, 1884, on Saginaw Bay" (N. A. Eddy, O. and O., Vol. X, p. 9).

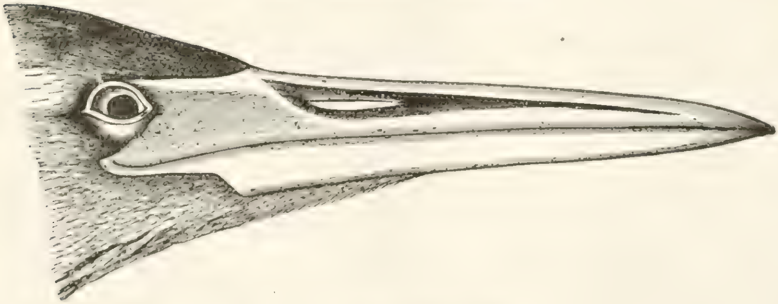
SUBORDER HERODII. HERONS, EGRETS, BITTERNS, ETC.

FAMILY ARDEIDÆ. HERONS; BITTERNS; ETC.

Feed on fish, frogs, toads, etc.; about marshes; not usually game birds.

SUBFAMILY BOTAURINÆ. BITTERNS.

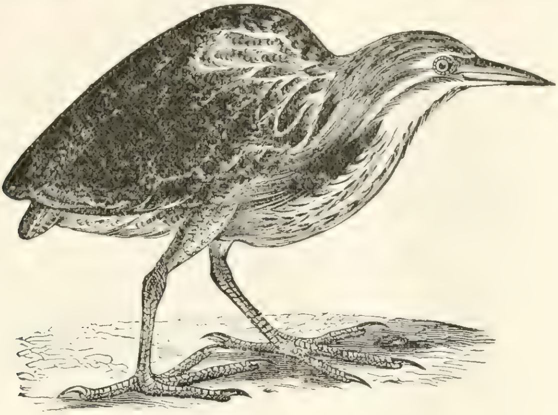
GENUS BOTAURUS HEERMANN.



Bill of Bittern, natural size.

79-190-(666). Botaurus lentiginosus (*Montag.*). *AMERICAN BITTERN; STAKE DRIVER; SHITEPOKE; INDIAN HEN; "THUNDER PUMPER;" "BARREL MAKER;" PLUM PUDDEN.

Common; throughout the state; April to August; "common in Monroe county" (Jerome Trombley); "breeds in great numbers in the marshes along the St. Joseph and Paw Paw rivers, but not common at Albion" (O. B. Warren); "rare at Mackinac Island, where one specimen was taken by T. G. White" (S. E. White); "common at Sault Ste. Marie" (A. H. Boies); "Keweenaw Point" (Kneeland); Mr. E. W. Durfee reports finding a nest with five eggs in Allegan county, May 28, 1891, and seeing two young not able to fly on Keweenaw Point; reported from Kent county and Ann Arbor; "breeds on Black River, Sanilac county. I have taken several specimens at Port Sanilac" (W. A. Oldfield); breeds, nests, but not in colonies, on the ground, usually in marshes and often surrounded by water; "breeds in great numbers about marshes in Shiawassee county" (Dr. W. C. Brownell); occasionally in meadows; nest elaborate; eggs three to seven, drab or mud color; the males make as a love note a sound like "plum pudden," also another like a ringing or pumping sound, as if pounding a barrel (see article by Bradford Torrey in The Auk for January, 1889); a very common bird in nearly all parts of Michigan; destroys field mice. For interesting articles on this bird by Dr. M. Gibbs, describing notes and contortions in uttering them, see O. and O.. Vol. XIV, 1889, p. 21, and Oölogist, Vol. X, 1892, p. 73.


Bittern, reduced.

80-191-(667). Botaurus exilis (*Gmel.*). LEAST BITTERN.

Common throughout Southern Michigan; summer resident; "abundant at Ann Arbor, where twenty-six specimens were shot in 1892, and half as many early in 1893. False nests are often built near the true nests. I found five nests at Ann Arbor in 1893. The male incubates, as I shot one as it rose from the nest. It is also abundant at Grand Rapids" (R. H. Wolcott); "common in Oakland County, where it breeds" (Dr. W. C. Brownell); "occasionally seen at Port Sanilac, and breeds below Detroit, where I have taken eggs" (W. A. Oldfield); "common in Monroe county" (Jerome Trombley); "common summer resident at St. Joseph and Albion" (O. B. Warren); one in collection of C. E. Holmes at Grand Rapids taken in Muskegon County; "all Southern Michigan" (A. H. Boies); breeds; nests in June, on the ground, in marshes on a simple platform of reeds and sedges, often half way up on dead flags, usually over the water, "occasionally in a bush" (Prof. J. W. Simmons); eggs three to six, white with bluish tinge: "nests in Oakland county" (Dr. W. C. Brownell in O. and O., Vol. XVI. p. 32); bird stupid and so easily caught. This species occurs in Sager's list of 1839.

SUBFAMILY ARDEINÆ. HERONS AND EGRETS.

GENUS ARDEA LINN.

The Blue Heron.

81-194-(655). Ardea herodias *Linn.* *GREAT BLUE HERON.

Very common; throughout the state; "Grand Traverse county where there is a heronry" (Dr. M. L. Leach); "common at Iron Mountain" (E. E. Brewster); S. E. White writes that it is a rare summer visitant at Mackinac Island, but common at Les Cheneaux; O. B. Warren reports it as a very common summer resident at St. Joseph and Albion, and not rare at Palmer, Marquette county; breeds in colonies;

nests in May, in tall trees, near marshes; "sticks in nests sometimes one inch in diameter and five feet long" (Prof. J. W. Simmons); Dr. W. C. Brownell knows of three heronries near Morrice, Shiawassee County. He says the stench is terrible at nesting time. There are often six nests in a tree. The trees, he says, are sure to die; eggs four to six, blue; S. E White took three nests with five, one with six and one with seven eggs from one tree, May 2, 1881. There was a large heronry just west of Lansing for years. The nests, which were numerous, were in large sycamores which stood in a large marsh. I secured several birds and eggs from this place. Dr. Steere reports heronries in black ash swamps about Ann Arbor. "Heronries are quite common in Southwestern Michigan. The birds fish three times daily. I have taken thirty-five minnows, from two to four inches long, from the stomach of one of these birds" (J. W. Simmons). C. B. Cook took a fish that was twelve inches long and weighed over one pound from the stomach of a Heron. These birds are often very fearless. I have often walked within a rod or two of a bird before it would fly; "occasionally seen near Port Sanilac. There is a Heronry south of Marlette in this, Sanilac, County" (W. A. Oldfield).

82-196 (658). Ardea egretta *Gmel.* American Egret; Great White Heron; Great White Egret.

Very rare; wanderer from the south; A. H. Boies reports it from Lenawee, Hillsdale, St. Joseph and Jackson Counties; Jerome Trombley reports it from Monroe Co., where he took one in 1889; "occasionally abundant in July and August, undoubtedly breeds in the state, but where?" (Dr. M. Gibbs); "Mr. E. W. Griffin took three from a flock of twenty at Albion in the fall of 1885, which are now in the Albion College museum" (O. B. Warren); "quite common in late summer in Wayne County, where they are taken half grown, but who knows where they breed?" (Dr. W. C. Brownell); we had one in our museum taken from Jackson Co.; one taken by J. B. Purdy at Plymouth and now in his cabinet; two taken at Greenville, Montcalm Co., in 1890 by Prof. James Satterlee; Dr. Atkins does not mention this bird; "breeds in Northern Wisconsin and without doubt in the Northern Peninsula of Michigan" (Prof. Ludwig Kumlein); doubtless breeds in Northern Indiana (Butler's Birds of Indiana); this species is given in Sager's list of 1839. There is a fine specimen in the collection of Mr. Levi Broas, taken in Ionia County.

83-197-(659). Ardea candidissima *Gmel.* Snowy Heron; Little White Egret.

Very rare; wanderer from the south; "a rare accidental visitor during July and August, does not breed" (Dr. M. Gibbs).

84-199-(660). Ardea tricolor ruficollis *Gosse.* Louisiana Heron; Louisiana Egret; Lady of the Waters.

Exceedingly rare; summer wanderer from the south; one specimen reported by E. L. Moseley in the catalogue of the Kent Scientific Institute at Grand Rapids; one reported by A. H. Boies from Lenawee Co.; one reported from Northern Indiana (Butler's Birds of Indiana); Dr. M. Gibbs thinks this bird should be omitted from the list.

85-201-(663). **Ardea virescens** *Linn.* GREEN HERON; FLY UP THE CREEK.

Common; "throughout the state" (A. H. Boies); summer resident; two killed on College farm in May; "common at Ann Arbor" (Dr. J. B. Steere); "common at Albion and St. Joseph" (O. B. Warren); Mr. E. W. Durfee reports finding a nest with three young in Allegan Co. in May, 1891; "common in Monroe Co." (Jerome Trombley); "quite common at Port Sanilac" (W. A. Oldfield); "Keweenaw Point" (Kneeland); found nesting at Plymouth by J. B. Purdy; often quite tame; breeds; nests often in small colonies, as does the Great Blue Heron, in May; eggs three to six, pale blue. There are several of these, taken in Ionia Co., in the collection of Mr. Levi Broas.

GENUS NYCTICORAX STEPH.

86-202-(664). **Nycticorax nycticorax nævius** (*Bodd.*). AMERICAN NIGHT HERON; BLACK-CROWNED NIGHT HERON; SQUAWK; NIGHT RAVEN.

Rare; taken on Chandler's marsh north of the College; "Southern Michigan" (A. H. Boies) "rare in Monroe Co." (Jerome Trombley) "one taken at Forestville and now mounted here. I have also seen it in the marshes at Black River" (W. A. Oldfield); one taken in Lenawee Co. by Dr. W. C. Brownell; one in collection of Levi Broas, taken in Ionia Co.; breeds; nests in June, in colonies, in trees; C. S. Osborn of Sault Ste. Marie writes me that there is a great colony on Espanore Island at the mouth of St. Mary's River. The Indians and fishermen eat the eggs. He has seen over one hundred nests there in the birch and balsam trees, the same nests are used over and over year after year. He adds these may possibly be the Great Blue Heron; eggs four, occasionally five or six; "three or four" (L. S. Foster), bluish; young birds in autumn said to be of good flavor and prized for the table.

87 203-(665). **Nycticorax violaceus** (*Linn.*). YELLOW-CROWNED NIGHT HERON.

"A specimen taken by a taxidermist at Forestville, Sanilac County, and now in his collection. I know of no other capture in Michigan" (W. A. Oldfield).

ORDER PALUDICOLÆ. CRANES; RAILS, ETC.

SUBORDER GRUES. CRANES.

FAMILY GRUIDÆ. CRANES.

Fine robust birds; feed on rootlets, grasses, grains, reptiles, toads, frogs, etc.

GENUS GRUS PALL.

88-204-(668). **Grus americana** (*Linn.*). WHOOPING CRANE; WHITE CRANE.

Very rare; probably accidental if it occurs at all; Covert says "very irregular visitor at Ann Arbor;" "occasionally seen both singly and in flocks of ten or twelve about marshes at Manchester, Washtenaw County, where it has been killed repeatedly" (L. W. Watkins); were these not mistaken identifications? "they probably were" (Dr. A. K. Fisher); Northern Indiana (Butler's Birds of Indiana). "Have taken several specimens at Port Sanilac, shot two in August, 1893, which are in my collection" (W. A. Oldfield).

89–205–(669). Grus canadensis (*Linn.*). Little Brown Crane.

"Transient visitor of the Upper Peninsula" (H. Nehrling); "doubtful" (Dr. A. K. Fisher).

90–206–(670). Grus mexicana (*Müll.*). *Sandhill Crane.

Decreasingly common; Southern Michigan, March to October; more common near marshes; Judge J. H. Steere of Sault Ste. Marie reports this species from the Upper Peninsula; "Keweenaw Point" (Kneeland); breeds; Dr. Atkins took a nest at Locke, June 18, 1879; "not rare and breeds in marshes in Monroe County" (Jerome Trombley); "never seen now in Kalamazoo County" (Dr. M. Gibbs); "rather common at St. Joseph, but rare at Albion" (O. B. Warren); nests in June on old sedges, on the ground; "nests at Sauger Lake, Shiawassee County" (Dr. W. C. Brownell); eggs two, drab, specked and spotted with brown. We have taken several of these birds here, old and young, which are now preserved in the museum. Mr. L. W. Watkins informs me that they appear often in Jackson County near small lakes, in large flocks of 100 or more, in October and November, where they feed extensively on corn, shelling and eating it after it is cut. A young one was reared by Mr. Watkins until two years of age. They are prized by some people for table use. Dr. Brownell writes me that he has known them to be so tame that he could walk to within twenty feet of them; the male often executes a queer dance, and their note is like the rapid stroke of a coarse cow bell.

Suborder RALLI. Rails; Gallinules; Coots, Etc.

Family RALLIDÆ. Rails; Gallinules, Etc.

Feed on reptiles and aquatic animals.

Subfamily RALLINÆ. Rails.

Genus RALLUS Linn.

91–208–(676). Rallus elegans *Aud.* King Rail; Red-breasted Rail; Fresh Water Marsh Hen.

Rather common; we have it from this place and Saginaw Bay: "Hillsdale County" (A. H. Boies); "abundant in marshes of Monroe County near Lake Erie" (Jerome Trombley); taken at St. Clair Flats, July 20. 1893, by Robt. H. Wolcott; "breeds at Plymouth, Wayne County" (J. B. Purdy); "a rare transient in Kalamazoo County, only twice captured to my knowledge" (Dr. M. Gibbs); "rare summer resident at St. Joseph, Berrien County" (O. B. Warren); breeds; nests on the ground; "nests abundantly in Wayne and St. Clair counties" (B. H. Swales); eggs, six to twelve, buff, spotted with varying hues of brown; a young bird in collection of E. S. Holmes, of Grand Rapids, was taken by him near the mouth of the Kalamazoo River, in Allegan County. Dr. W. C. Brownell writes me that he took ten eggs from a nest. The old bird was very fearless. He has seen the young, mere puffs of black down, leave the nest within a half hour of hatching.

92-212-(677). Rallus virginianus *Linn.* *Virginia Rail.

Very common; Southern Michigan; May to September; "abundant in Southwestern Michigan" (Prof. J. W. Simmons); "very common summer resident at St. Joseph, but rare at Albion" (O. B. Warren); "abundant about marshes in Monroe County, near Lake Erie" (Jerome Trombley); S. E. White reports it a very rare summer resident at Mackinac Island; "breeds near St. Clair" (B. H. Swales); "this bird and the next species are quite common in the marshes along small creeks and streams, at Port Sanilac" (W. A. Oldfield); nests on stems of flags, etc., on the ground; eggs, six to twelve, usually seven or eight, creamy white, spotted with small spots of reddish brown. I have found these common here and very common at Saginaw Bay. Mr. L. W. Watkins tells me that they nest very abundantly at Traverse City. This is hunted as a game bird, but is rather inferior for table use; "these birds never commence to sit till a full complement of eggs is laid" (J. B. Purdy).

Genus PORZANA Vieill.

Carolina Rail, reduced.

93-214-(679). Porzana carolina (*Linn.*). *Sora; Carolina Rail; Crake; Ortolan.

Very common; Southern Michigan; May to October; "abundant in Southern Michigan" (J. W. Simmons); "Looking Glass River near DeWitt" (Dr. G. W. Topping); breeds; "not uncommon on Portage Lake, Keweenaw Point" (Kneeland); "incubation and laying conterminous, so that hatching continues for days" (B. H. Swales); "common summer resident at Mackinac Island" (S. E. White); "nests abundantly at Plymouth, Wayne County" (James B. Purdy); "breeds abundantly in Saginaw marshes" (N. A. Eddy); Mr. Jerome Trombley finds it breeding in Monroe County; I have taken the eggs abundantly at Saginaw; nests in June, on ground, in bog or meadow; eggs, five to fourteen, very rarely to twenty, drab, with yellowish tint, darker and with larger spots than those of the Virginia Rail; often in flocks; excellent game bird, though not good shooting, as they are slow to take wing; "I have taken twenty eggs from one nest. The bird commences to sit as soon as the first egg is laid, so the eggs are at all stages of incubation" (J. B. Purdy).

94-215-(680). Porzana noveboracensis (*Gmel.*). Yellow Rail; Yellow Crake.

Rare; "probably breeds" (Gibbs' Birds of Michigan); reported in Michigan (Forest and Stream, Vol. XXV, p. 347); see Butler's Birds of Indiana; "summer resident" (Dr. J. B. Steere).

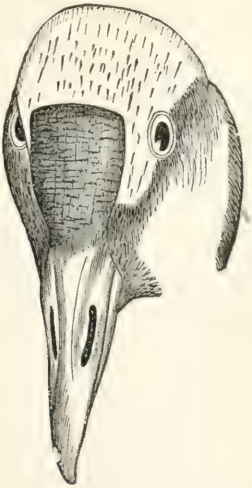
SUBFAMILY GALLINULINÆ. GALLINULES.

GENUS GALLINULA BRISS.

95-219-(684). Gallinula galeata (*Licht.*). *FLORIDA GALLINULE.

Common; "Hillsdale Co." (A. H. Boies); Mr. Boies thinks they migrate at night, but not in flocks; "common at Saginaw" (Miles' Birds of Michigan, p. 231); "breeds at Plymouth" (J. B. Purdy); Mr. Robt. H. Wolcott writes me that he took a nest at St. Clair Flats, July 20, 1893; "have seen thousands at St. Clair Flats" (Dr. W. C. Brownell); "very common summer resident at St. Joseph and Albion, and breeds at both places" (O. B. Warren); taken at the college; breeds; we have eggs in the museum taken near Grand Ledge; "many nests found in Kalamazoo Co." Dr. M. Gibbs); nests and eggs as in the following species; a fine table bird.

GENUS FULICA LINN.



Frontal Shield of Coot.

96-221-(686). Fulica americana *Gmel.* *AMERICAN COOT; COOT; MUD HEN.

Very common; throughout the entire state; "do not summer in Kalamazoo County, but are abundant in migrations" (Dr. M. Gibbs); "very common and fearless at St. Joseph, and common at Adrian" (O. B. Warren); "common in Upper Peninsula" (E. E. Brewster); "Keweenaw Point" (Kneeland); reported from Mackinac Island; summer months; breeds; Robt. H. Wolcott took several nests on St. Clair Flats, July 20, 1893; nests on the ground, frequently on floating nests; eggs six to twelve, occasionally fifteen, elongate, yellowish drab, spotted with fine dark spots. I have found the nests and eggs very common at Saginaw Bay; "common along the shore marshes of Sanilac Co." (W. A. Oldfield).

ORDER LIMICOLÆ. SHORE BIRDS.

FAMILY PHALAROPODIDÆ. PHALAROPES.

Typical waders; food, insects, molluscs, crustaceans, etc.

GENUS CRYMOPHILUS VIEILL.

97-222 (604). Crymophilus fulicarius (*Linn.*). RED PHALAROPE; GRAY PHALAROPE.

Northern Indiana, rare, probable migrant, probably in Southern Michigan (Butler's Birds of Indiana); embraced in Stockwell's Birds of Michigan; Dr. Steere classifies it among Michigan migrants; Prof. Ludwig Kumlein writes me that this bird breeds in the Northern Peninsula, which, writes Dr. A. K. Fisher, seems very improbable.

GENUS PHALAROPUS BRISS.

Northern Phalarope, nat. size.

98-223-(603). Phalaropus lobatus (*Linn.*). NORTHERN PHALAROPE; RED-NECKED PHALAROPE.

Exceedingly rare; "rare visitor" (Dr. Morris Gibbs); Dr. J. B. Steere classifies this doubtfully as a Michigan migrant; record by R. B. Lawrence of occurence of this bird at Monroe, Michigan (Forest and Stream, Vol. XXV, p. 372); Prof. Ludwig Kumlein writes me that it breeds in Northern Wisconsin and presumably in our Northern Peninsula. I think he must refer to Wilson's Phalarope.

Wilson's Phalarope, natural size.

99-224-(602). Phalaropus tricolor (*Vieill.*). WILSON'S PHALAROPE.

"Common, irregular, transient, only occasionally seen, taken in May and Sept. in Kalamazoo Co." (Dr. M. Gibbs); Dr. J. B. Steere puts it doubtfully among the summer residents; W. A. Oldfield has taken it at Port Sanilac; taken by E. E. Brewster at Iron Mountain, May 2, 1890; "Keweenaw Point" (Kneeland); northern counties of Indiana, where it breeds (Butler's Birds of Indiana).

FAMILY RECURVIROSTRIDÆ. AVOCETS AND STILTS.

Very long bills and legs; food small molluscs, crustaceans and insects.

GENUS RECURVIROSTRA LINN.

100–225–(600). Recurvirostra americana (*Gmel.*). AMERICAN AVOCET.

"One specimen from Michigan in the Kent Scientific Institute" (E. L. Moseley); one taken by W. H. Collins near Detroit; embraced in Butler's Birds of Indiana.

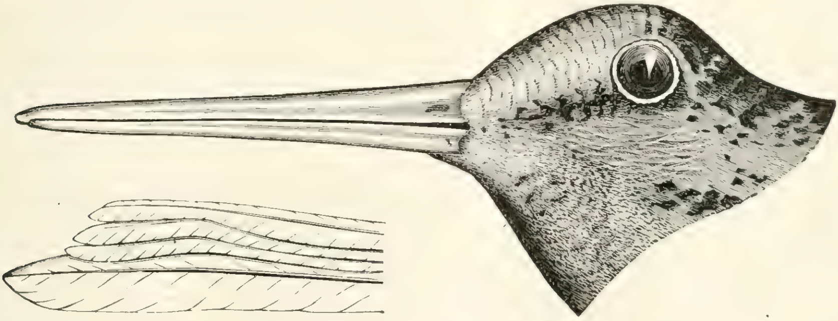
GENUS HIMANTOPUS BRISS.

101–226–(601). Himantopus mexicanus (*Müll.*). BLACK-NECKED STILT.

"Rare transient" (Gibbs' Birds of Michigan); of doubtful occurence in Michigan. Dr. Steere gives it doubtfully as breeding in Michigan.

FAMILY SCOLOPACIDÆ. SNIPES, SANDPIPERS, ETC.

Feed on small aquatic animals, insects, etc.; eggs densely spotted, usually pointed at one end; game birds.



Woodcock, head and outer primaries, natural size.

GENUS PHILOHELA GRAY.

102–228–(605). Philohela minor (*Gmel.*). *AMERICAN WOODCOCK.

Common from March, rarely February, to October or November; "occasionally every month of the year" (Gibbs); throughout the state; "formerly very common in Wayne County, but goes as the marshes are drained" (Dr. W. C. Brownell); "common along Black River in Sanilac Co." (W. A. Oldfield); "very common at St. Joseph, where it breeds, but a rare migrant at Albion and Palmer, Marquette Co." (O. B. Warren); R. H. Wolcott saw one January 1, 1888, at Grand Rapids, when the snow was one foot deep; reported from Presque Isle Co.; "Grand Traverse Co." (Dr. M. L. Leach); "rare summer resident at Mackinac Island" (S. E. White); "Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); "have seen two specimens on Keweenaw Point" (E. W. Durfee); breeds; nests in April, on the ground in thick brush; bird so mimics the brush and leaves when on the nest that it is seen with great difficulty; eggs four, gray, specked and spotted with dark brown; esteemed as a game bird; taken at the College, October 30, 1892.

GENUS GALLINAGO LEACH.

Wilson's Snipe, reduced.

103-230-(608). Gallinago delicata (*Ord.*). * WILSON'S SNIPE; JACK SNIPE; AMERICAN SNIPE.

Common in April and October; throughout the state; not very rare in summer; reported in Presque Isle and Muskegon Counties; "taken at Port Sanilac, but is not known to breed" (W. A. Oldfield); "rare migrant at Mackinac Island where I killed one September 17, 1889" (S. E. White); "Keweenaw Point" (Kneeland); said to breed; "found breeding once" (Dr. M. Gibbs); nests on the ground in May; eggs four, colors as above; prized as a game bird; "I have seen it but only as a migrant" (Dr. W. C. Brownell); "common migrant at St. Joseph and Albion" (O. B. Warren); somewhat gregarious; this bird, according to Butler, is known as English Snipe, Common Snipe and Gutter Snipe.

GENUS MACRORHAMPHUS LEACH.

104 232-(610). Macrorhamphus scolopaceus (*Say*). RED-BREASTED SNIPE; GRAY SNIPE; GRAYBACK; GRAY-BACKED SNIPE; LONG-BILLED DOWITCHER; DOWITCHER.

Migrant; "a small flock was seen in Kalamazoo County May 21, 1888" (Dr. M. Gibbs); "occasionally seen in Hillsdale and Lenawee Counties" (A. H. Boies); doubtfully given as a Michigan migrant by Dr. J. B. Steere; "Keweenaw Point" (Kneeland); Prof. Ludwig Kumlein writes me that it breeds in the Northern Peninsula; Davie, p. 111, states that this species breeds on the border of Lake Superior and north; small flocks about marshes; excellent table bird.

GENUS MICROPALAMA BAIRD.

105 233 (611). Micropalama himantopus (*Bonap.*). STILT SANDPIPER.

"Not rare; some seasons near large bodies of water and occasionally taken in the interior" (Dr. M. Gibbs); Dr. J. B. Steere gives it as a doubtful Michigan migrant; "Keweenaw Point (Kneeland); Prof. Ludwig Kumlein writes me that it breeds in the Northern Peninsula, which seems hardly probable. "Was taken near Lafayette, Ind., in spring of 1892; first Indiana record" (A. W. Butler).

GENUS TRINGA LINN.

106-234 (626). Tringa canutus *Linn.* KNOT; RED-BREASTED SANDPIPER; ROBIN SNIPE.

"Rare migrant" (Dr. M. Gibbs); "migrant" (Dr. J. B. Steere); included in list of Rev. Chas. Fox; May and September; small flocks; if this bird occur in Michigan, it is very rarely.

107-239-(616). Tringa maculata *Vieill.* PECTORAL SANDPIPER; "JACK SNIPE;" GRASS SNIPE.

Very abundant; migrant; "throughout the state" (A. H. Boies); 'very common on Lake Erie in Monroe County" (Jerome Trombley); "not rare migrant at St. Joseph and Albion" (O. B. Warren); "taken at Plymouth" (J. B. Purdy); "quite common along marshy creeks of Sanilac county" (W. A. Oldfield); "not rare but decidedly irregular in spring and autumn" (Dr. M. Gibbs); we have taken several here at Lansing; May and September; flocks about marshes; migrant; good game bird; feeds extensively on locusts and other insects.

108-240-(617). Tringa fuscicollis *Vieill.* WHITE-RUMPED SANDPIPER; BONAPARTE'S SANDPIPER.

"Not common north" (Gibbs' Birds of Michigan); "breeds far north of us" (Dr. A. K. Fisher); Jerome Trombley reports it not rare about Lake Erie; "migrant at Plymouth" (J. B. Purdy); "migrant" (Dr. J. B. Steere); "a rather rare, irregular migrant" (Dr. M. Gibbs); "breeds far north" (H. Nehrling).

109-241-(615). Tringa bairdii (*Coues*). BAIRD'S SANDPIPER.

This specimen is embraced in Covert's Birds of Michigan, Cabot's Birds of Lake Superior, and is given by Wheaton as a migrant in Ohio.

110-242-(614). Tringa minutilla *Vieill.* LEAST SANDPIPER.

Common in spring and fall; April and Sept; "throughout the state" (A. H. Boies); Jerome Trombley reports it very rare in Monroe Co.; "not rare in Kalamazoo Co." (Dr. M. Gibbs); "rare migrant at St. Joseph and Albion" (O. B. Warren); "I see it often in flocks in spring and fall in Shiawassee County, about lakes" (Dr. W. C. Brownell); "migrant at Plymouth" (J. B. Purdy); "common at Port Sanilac in spring and fall" (W. A. Oldfield); "migrant in Allegan Co." (S. E. White); Mr. White also reports it a rare migrant at Mackinac Island; taken by E. E. Brewster, May 24, 1891, at Iron Mountain; "breeds in British America" (Dr. A. K. Fisher); "so far as we know breeds north of the United States" (H. Nehrling); "this and the preceding species breed far north of us" (Prof. J. A. Allen).

111-243a-(624). Tringa alpina pacifica *Coues.* RED-BACKED SANDPIPER; BLACK-BELLIED SANDPIPER; AMERICAN DUNLIN.

"Migrant, not common, few taken in spring" (Dr. M. Gibbs); "breeds in Sanilac Co. where female was taken on nest, three eggs and bird now in my collection" (W. A. Oldfield); "one bird taken at Plymouth in the spring of 1891" (J. B. Purdy); "Allegan County, migrating May 25, 1891" (S. E. White, O. and O., Vol. 16, p. 9); "migrant" (Dr. J. B. Steere); prized for food.

112-244-(625). Tringa ferruginea *Brünn.* CURLEW SANDPIPER.

Very rare visitor; one taken by the late D. D. Hughes; reported in the catalogue of Kent Scientific Institute by E. L. Moseley.

GENUS EREUNETES ILL.

113-246-(612). Ereunetes pusillus (*Linn.*). SEMIPALMATED SANDPIPER.

Common; "throughout the state" (A. H. Boies); migrant; "rare in Monroe Co." (Jerome Trombley); "spring and fall, at Port Sanilac" (W. A. Oldfield); "taken as late as June and as early as August" (Dr. M. Gibbs); "Mackinac Island where I took one specimen Sept. 4, 1889" (S. E. White); "Keweenaw Point" (Kneeland); "Shore of Lake Michigan during August" (Butler's Birds of Indiana).

GENUS CALIDRIS CUV.

114-248-(627). Calidris arenaria (*Linn.*). SANDERLING.

"Common migrant near Lake Erie" (Jerome Trombley); "see flocks at Port Sanilac, but only in spring" (W. A. Oldfield); "common on the shores of the Great Lakes, migrant" (Gibbs' Birds of Michigan); "very common, in flocks, on the shore of Lake Michigan" (Butler's Birds of Indiana).

GENUS LIMOSA BRISS.

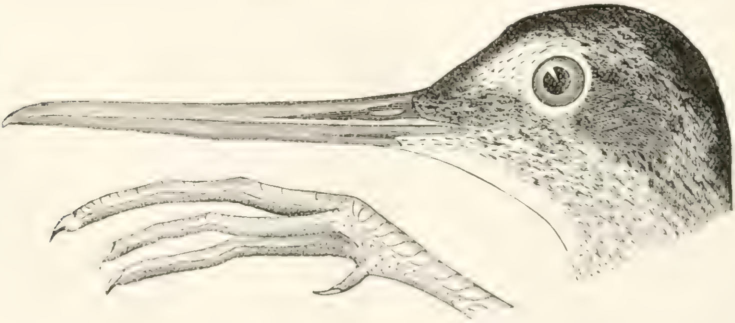
115-249 (628). Limosa fedoa (*Linn.*). MARBLED GODWIT; GREAT MARBLED GODWIT; DOE BIRD; DOUGH BIRD.

Rare; shores of the Great Lakes; May and Sept.; migrant; "taken near Lake Erie by gamesters (gunners)" (Jerome Trombley); "one male shot at Port Sanilac" (W. A. Oldfield); "not uncommon about Lake Michigan" (Brayton); "migrant" (Dr. J. B. Steere); Davie, p. 117, says it is known to breed in Northern Ohio and Wisconsin; Prof. Ludwig Kumlein writes me that it breeds in Northern Wisconsin, and presumably in our Northern Peninsula, and Mr. H. Nehrling informs me that it breeds in Northern Michigan.

116-251-(629). Limosa hæmastica (*Linn.*). HUDSONIAN GODWIT; LESSER DOE BIRD.

Rare; migrant; about Great Lakes; "taken near Lake Erie by gamesters" (Jerome Trombley); "not very rare about Lake Michigan" (Brayton); given doubtfully by Dr J. B. Steere as a migrant; "taken at Niles and in Calhoun Co." (D. D. Hughes).

GENUS TOTANUS BECHSTEIN.



Greater Yellow Legs, natural size.

117-254 (633). Totanus melanoleucus (*Gmel.*). Greater Yellow Legs; Greater Telltale; Greater Tattler; Stone Snipe.

Abundant; throughout the state; May and Oct.; migrant; "Keweenaw Point" (Kneeland); "common in spring at Iron Mountain" (E. E. Brewster); "common in Monroe Co." (Jerome Trombley); "common in spring and fall at Port Sanilac, most in fall" (W. A. Oldfield); "common migrant at Albion and St. Joseph" (O. B. Warren); one of our most common long-billed migrants; possibly may tarry occasionally and breed. Prof. Ludwig Kumlein writes me that this species breeds in our Northern Peninsula. Mr. H. Nehrling writes to the same effect. This and the following species are reported by Mr. A. W. Butler as breeding rarely in Northern Indiana.

118-255-(634). Totanus flavipes (*Gmel.*). Yellow Legs; Lesser Tattler; Yellow Shanks.

Common; throughout the State; "abundant in Monroe Co." (Jerome Trombley); "quite common at Port Sanilac in spring, but not found breeding" (W. A. Oldfield); "Kent and Allegan Counties" (S. E. White); "rare migrant at St. Joseph and Albion" (O. B. Warren); "Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); embraced in Cabot's Birds of Lake Superior; common about the college; migrant; occasionally in summer; reported as breeding; "neither this nor the preceding species breeds at Plymouth" (J. B. Purdy); eggs three or four; often occurs in flocks.

Solitary Sandpiper, natural size.

119-256-(637). Totanus solitarius (*Wils.*). *Solitary Sandpiper; Solitary Tattler; Wagtail; Tip-up; American Green Sandpiper.

Common; May to Sept.; abundant in the marshes about the College; "common about Hillsdale" (F. M. Falconer); "rare in Monroe County, but does not breed" (Jerome Trombley); "common at Albion and St. Joseph" (O. B. Warren); "Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "rare in spring at Port Sanilac" (W. A. Oldfield); taken on Keweenaw Point by E. W. Durfee, August, 1892; breeds northward; nests on ground; not in flocks. This bird bobs its head instead of tipping its tail.

Genus SYMPHEMIA Rafin.

120-258-(632). Symphemia semipalmata (*Gmel.*). Willet; Semipalmated Tattler.

Rare; summer resident; admitted doubtfully by Dr. Steere; May to September; Dr. Atkins reports taking this bird at Locke, August 13, 1885; Dr. M. Gibbs writes me that this bird has been shot at Grand Rapids; "Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); table bird.

Genus BARTRAMIA Less.

121-261-(640). **Bartramia longicauda** (*Bechst.*). Bartramian Sandpiper; Bartramian Tattler; Field Plover; Upland Plover; Prairie Plover.

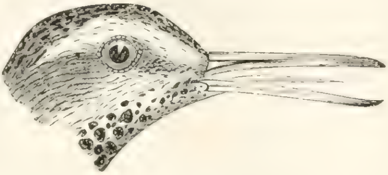
Common; April to Sept. reported from Wayne Co. "Lenawee Co." (A. H. Boies); breeds; "does not breed in Monroe Co." (Jerome Trombley); "nests on ground in Kalamazoo Co., eggs four" (Dr. M. Gibbs); E. W. Durfee knows of its breeding in Wayne County; Davie, p. 125, says it is known to breed in several portions of Michigan; nests in May on the ground; eggs four, gray or buff, specked with different shades of brown; excellent table bird. This species is enbraced in Dr. Sager's list of 1839; "common in fall and spring at Port Sanilac, where a few breed, found a nest with four eggs May, 1893" (W. A. Oldfield).

Genus TRYNGITES Cab.

122 262 (641). **Tryngites subruficollis** (*Vieill.*). Buff-breasted Sandpiper.

Admitted doubtfully among Michigan birds by Dr. J. B. Steere; "rare, only twice taken, Sept. 17, 1875, and Sept. 14, 1872, not yet observed in spring" (Dr. M. Gibbs); rare; migrant; prized for table; "too rare for a game bird" (Prof. Ludwig Kumlein); "taken near Lafayette, Ind., in the spring of 1892" (A. W. Butler).

Genus ACTITIS Ill.



Spotted Sandpiper, natural size.

123 263 638). **Actitis macularia** (*Linn.*). *Spotted Sandpiper; Sandpiper; Peet-weet; Spotted Tattler; Wagtail; Tip-up; Teeter Tail.

Exceedingly abundant; "throughout the state" (A. H. Boies); April to Oct.; "very common from early spring till late fall, at Port Sanilac, breeds abundantly, found over a dozen nests this spring" (W. A. Oldfield); "abundant in Monroe Co." (Jerome Trombley); "very common summer resident at Mackinac Island" (S. E. White); "very abundant summer resident at Albion, St. Joseph, and Palmer, Marquette Co." (O. B. Warren); "very abundant at Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); breeds abundantly, nests in April, on the ground, in the garden, field or woodland; eggs four, yellowish white, with spots of muddy brown. The name, Tip-up, comes from the habit of jerking its tail which habit it shares with several other species. "The young are beautiful little things, and run about, soon after hatching, in a very sprightly manner" (L. S. Foster).

GENUS NUMENIUS BRISS.

124 264 (643). Numenius longirostris *Wils.* LONG-BILLED CURLEW; SICKLE-BILLED CURLEW.

Long-billed Curlew.

Rare migrant; "rare near Lake Erie" (Jerome Trombley); admitted doubtfully among Michigan migrants by Dr. J. B. Steere; "breeds in the Upper Peninsula" (H. Nehrling); valuable table bird.

125 265-(645). Numenius hudsonicus *Lath.* HUDSONIAN CURLEW; JACK CURLEW; SHORT-BILLED CURLEW.

Very rare; "only two taken to my knowledge" (Gibbs' Birds of Michigan); "never seen in Monroe Co." (Jerome Trombley); admitted doubtfully by Dr. J. B. Steere among Michigan migrants.

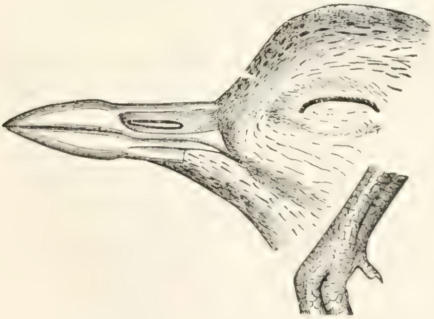
126-266-(646). Numenius borealis (*Forst.*). ESKIMO CURLEW.

Exceedingly rare; one specimen reported by Dr. M. Gibbs; admitted doubtfully by Dr. J. B. Steere; Benj. Syke, of Kalamazoo, records one as late as Oct. 28; migrant; gregarious; about marshes; excellent for table.

FAMILY CHARADRIIDÆ. PLOVERS.

Feed on insects, crustaceans, molluscs, etc.; eggs usually dark and spotted; some species valuable as game birds.

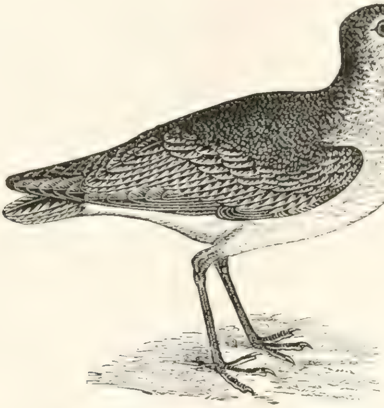
GENUS CHARADRIUS LINN.



Black-bellied Plover, natural size.

127-270-(580). Charadrius squatarola (*Linn.*). BLACK-BELLIED PLOVER; BULL-HEAD.

Rare migrant; A. H. Boies reports it from Lenawee and Hillsdale Counties; "Monroe Co." (Jerome Trombley); "once as late as Oct. 20" (Dr. M. Gibbs); "occasional at Palmer, Marquette Co." (O. B. Warren); "Keweenaw Point" (Kneeland); "a regular migrant along the Great Lakes, Superior included" (Prof. Ludwig Kumlein).

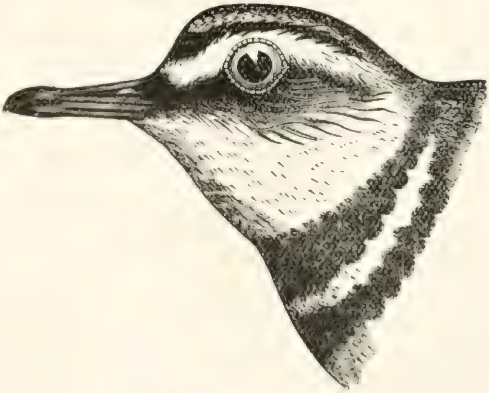


Golden Plover, in fall or winter, reduced.

128-272 (581). Charadrius dominicus *Müll.* AMERICAN GOLDEN PLOVER; GREEN-BACK.

Common; throughout the state; April and Oct.; migrant. This bird is not mentioned by Dr. H. A. Atkins, but it has been taken here repeatedly; Mr. Jerome Trombley reports it as a common migrant near Lake Erie; "large flocks appeared at Lansing in Sept. 1890, and many were killed" (J. E. Nichols); taken at Plymouth by J. B. Purdy; "common migrant at Albion, and common in fall migrations at Palmer, Marquette Co." (O. B. Warren); "Keweenaw Point" (Kneeland); "common transient in the autumn, but rarely seen in spring, often in large flocks, most abundant about Sept. 28, in Kalamazoo Co." (Dr. M. Gibbs); "very common at Port Sanilac, fall of 1890, but rare since, only seen in fall and spring" (W. A. Oldfield).

GENUS ÆGIALITIS BOIE.



Kildeer, natural size.

129-273 (584). Ægialitis vocifera (*Linn.*), *KILLDEER; KILLDEER PLOVER; RING PLOVER.

Very abundant; throughout the entire state; common from March to Dec.; often seen in winter; valuable as a destroyer of insects; our most common plover; frequents gardens, pastures and roadsides; "very common at Albion and St. Joseph, where I once took an abnormally large egg, which contained a double yolk, but never seen at Palmer" (O. B. Warren); "very common throughout the season at Port Sanilac with eggs as stated by Dr. Brownell" (W. A. Oldfield); "Mackinac Island" (S. E. White; "occasional at Iron Mountain" (E. E. Brewster) breeds; nests often as early as March, on the ground, usually on a knoll, in gardens and pastures; eggs four, yellowish white, spotted with dark brown. Dr. Brownell writes me that the eggs are always arranged in the form of a cross with the small or pointed ends toward the center.

130-274-(586). Ægialitis semipalmata *Bonap.* *SEMIPALMATED PLOVER; RING PLOVER; RING NECK.

Common; Migrant; May and Sept.; Jerome Trombley has taken it in Monroe Co.; "Upper Peninsula" (A. H. Boies); "Keweenaw Point" (Kneeland); taken by J. B. Purdy at Plymouth; "common at Morrice" (Dr. W. C. Brownell); said to be a summer resident north. We have taken this bird here at the college in early spring. Dr. Atkins reports taking one at Locke, Aug. 19, 1884; "northern part of Indiana" (Butler's Birds of Indiana).

131-277-(587). Ægialitis meloda (*Ord.*). PIPING PLOVER; PIPING RING PLOVER.

Rather rare; migrant; "rare migrant in Monroe Co." (Jerome Trombley); "I have shot it as a migrant in Allegan Co." (S. E. White), embraced in the lists of Hughes. Boies, Covert and Gibbs. These notes may refer to the next species.

132-277a-(588). Ægialitis meloda circumcincta *Ridgw.* BELTED PIPING PLOVER.

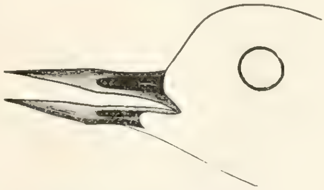
"Migrant, not common, summer resident northward" (Butler's Birds of Indiana); "common summer resident along the shore of Lake Michigan" (Dr. Brayton). Prof. A. W. Butler thinks this species more common in Northern Indiana than the preceding. I have no positive evidence of the occurrence of this bird in our state.

FAMILY APHRIZIDÆ. SURF BIRDS AND TURNSTONES.

Feed on crustaceans, shell fish, etc.

SUBFAMILY ARENARIINÆ. TURNSTONES.

GENUS ARENARIA BRISS.



Turnstone, natural size.

133-283-(598). Arenaria interpres (*Linn.*). TURNSTONE.

"A rare irregular migrant in Kalamazoo Co., taken once as late as May 2, showing it to be a spring migrant" (Dr. M. Gibbs); "two specimens shot in northern Sanilac Co., and now in a collection at Forestville" (W. A. Oldfield); "common along Lake Michigan" (Brayton); included in Sager's list of 1839.

ORDER GALLINÆ. GALLINACEOUS BIRDS.

These birds are granivorous and possess strong claws for scratching. They include most of our domestic birds.

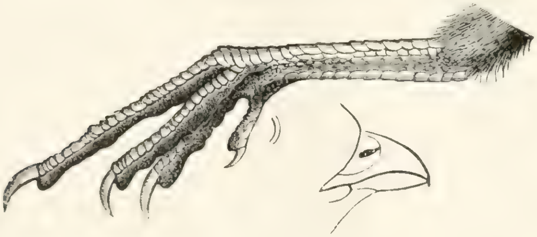
SUBORDER PHASIANI. PHEASANTS, GROUSE, PARTRIDGES, QUAIL, ETC.

FAMILY TETRAONIDÆ. GROUSE, PATRIDGES, ETC.

Feed on insects, grass, seeds, etc.; fine game birds; flocks; generally polygamous; do little injury, and are of immense economic importance.

SUBFAMILY PERDICINÆ. PARTRIDGES.

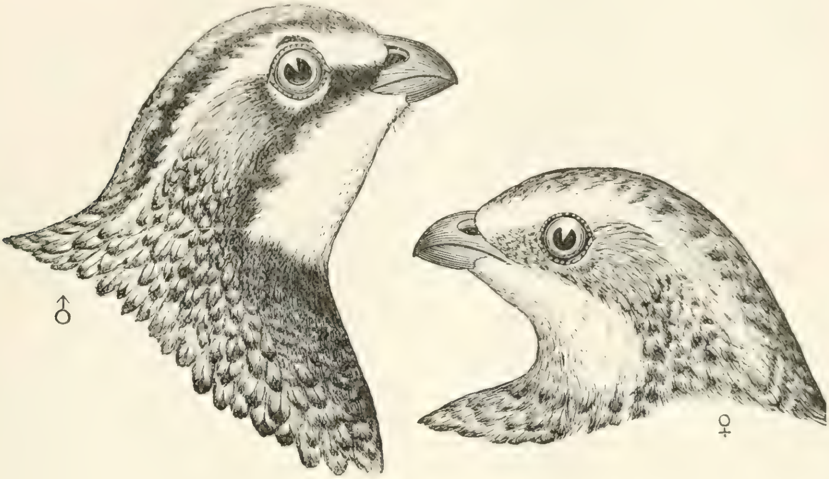
GENUS COLINUS LESS.



Quail, natural size.

134-289 (571). Colinus virginianus (*Linn.*). *BOB WHITE; QUAIL; PARTRIDGE.

Very common; throughout the southern Peninsula; all seasons of the year; large flocks; very tame; frequent lawns and barnyards in winter; "common at Bay City in 1883, and greatly thinned out by the severe winters, now common again" (N. A. Eddy); "never seen at Iron Mountain" (E. E. Brewster); "not generally found much north of Petoskey, though two were seen on Mackinac Island, September. 1890" (S. E. White); "common at Port Sanilac where it breeds till middle of August" (W. A. Oldfield); "Keweenaw Point" (Kneeland); "becoming a very abundant resident at Albion and St. Joseph, but never seen at Palmer, Marquette Co., was not Kneeland mistaken in reporting this from Keweenaw Point?" (O. B. Warren); breeds; nests in summer, occasionally as late as September, on the ground; eggs white, pointed at one end, numerous; J. B. Purdy has taken twenty-one eggs from a single nest; "I took thirty-eight eggs from one nest" (Dr. W. C. Brownell); prized as a game bird; very useful in destroying insects, seeds of weeds, etc.; this species has been temporarily protected in our state; "so excellent a friend should be permanently protected" (Prof. James Satterlee); "more common in Monroe Co. than it was ten years ago" (Jerome Trombley). The name partridge is used south and east.



Quail, male and female, natural size.

Genus DENDRAGAPUS Elliot.

135-298-(555). Dendragapus canadensis (*Linn.*). Canada Grouse; Spruce Partridge.

Common north; I have it from Ionia Co.; taken in winter; "formerly very abundant in all the scrub pine thickets in the northern counties, very tame and stupid, and so. easily exterminated" (C. J. Davis); "does not inhabit the shore counties of northwestern Michigan, I only find it near Higgins and Houghton lakes" (Dr. M. L. Leach); common on north branch of Au Sable River" (N. A. Eddy in O. and O., Vol. IX. p. 41); "Upper Peninsula" (A. H. Boies); "rare on Keweenaw Point" (Kneeland); "rare about Palmer except in some localities, where, from its stupidity it is likely to be speedily exterminated" (O. B. Warren); "occasional at Iron Mountain" (E. E. Brewster and S. E. White); "not found in Kalamazoo Co., but common north" (Dr. M. Gibbs); Dr W. C. Brownell took a straggler in Washtenaw Co. in the fall of 1887; included in Sager's list of 1839, and Cabot's of 1850; breeds in the northern part of the state. I have reports of its breeding in the Northern Peninsula: "I know that it breeds in Northern Michigan and the Northern Peninsula" (Prof. Ludwig Kumlein); "common in the Gogebic region" (H. Nehrling).

GENUS BONASA STEPH.

136-300 (565). Bonasa umbellus (*Linn.*). *RUFFED GROUSE; "PARTRIDGE," in Michigan, "PHEASANT," south.

Ruffed Grouse, natural size.

Very common, though decreasing in number; throughout the entire state; "still abundant about Ann Arbor" (Dr. J. B. Steere); "abundant at Bay City where many are killed by sportsmen" (N. A. Eddy); "common at Iron Mountain" (E. E. Brewster); "very common at Keweenaw Point" (Kneeland); "not seen on Mackinac Island, though common on the mainland north and south" (S. E. White); "very common resident at Albion and St. Joseph, and common at Palmer, Marquette Co., where it is less shy than in the Southern Peninsula" (O. B. Warren); "common at Port Sanilac through the year" (W. A. Oldfield); breeds; nests in June, on the ground, nests said to be often concealed by logs, etc.; "I never find them so" (Prof. Ludwig Kumlein); "always covers eggs with leaves before leaving the nest" (J. B. Purdy); I have always found the nests of eggs entirely exposed; eggs six to fifteen, usually ten to twelve, creamy white to buff, occasionally spotted with fine reddish dots; seen through the year; excellent game bird; occasionally fly into houses in autumn through windows. This bird is known by the drumming of the male with its wings, which may be heard for a long distance. This bird eats berries, nuts, especially beech nuts, and insects. In the autumn it eats many grasshoppers and such caterpillars as the oak caterpillar, *Edema albifrons*. My son, A. B. Cook, thinks that they never cover their eggs, except as they accidentally sweep the leaves over the eggs as they take wing. The drumming for which this bird is noted is probably caused by the wings striking the air.

GENUS LAGOPUS BRISS.

137-301-(568). Lagopus lagopus (*Linn.*). WILLOW PTARMIGAN.

Reported from Upper Peninsula (See Gibbs' list of Michigan Birds); "habitat Minnesota" (Birds of Minnesota, Hatch, 1892, p. 162); "Keweenaw Point" (Kneeland); "south to Southern New York" (Jordan); pure white in winter.

GENUS TYMPANUCHUS GLOGER.

138 305 (563). Tympanuchus americanus (*Reich.*). *PRAIRIE HEN; PRAIRIE CHICKEN; PINNATED GROUSE.

Quite common; formerly very rare here, but common in the southwestern part of the state; "formerly abundant but now extinct at Ann Arbor" (Dr. J. B. Steere); "extinct in Monroe Co. for more than thirty years" (Jerome Trombley); "never seen at Port Sanilac" (W. A. Oldfield); "very common in Southwestern Michigan" (Prof. J. W. Simmons); more frequent in prairie region; seen through the year; breeds; nests in June, on the ground; nest said to be often concealed by leaves, etc.; eggs eight to fourteen, gray, often specked with brown; destroys many insects; excellent game bird; Dr. Atkins found a nest in June, 1879; he reports them very common at Locke in January, 1878; embraced in Sager's list of 1839; "should be carefully protected as it is a valuable friend to the farmer" (Dr. A. K. Fisher).

GENUS PEDIOCÆTES BAIRD.

139-308-(562). Pediocætes Phasianellus campestris *Ridgw.* PRAIRIE SHARP-TAILED GROUSE.

A. B. Covert feels very certain that this species is very abundant in the Northern Peninsula; "Michigan" (Coues).

FAMILY PHASIANIDÆ. PHEASANTS; ETC.

Large fine game birds, gregarious, polygamous.

SUBFAMILY MELEAGRINÆ. TURKEYS.

GENUS MELEAGRIS LINN.

140-310-(554). Meleagris gallopavo *Linn.* * WILD TURKEY.

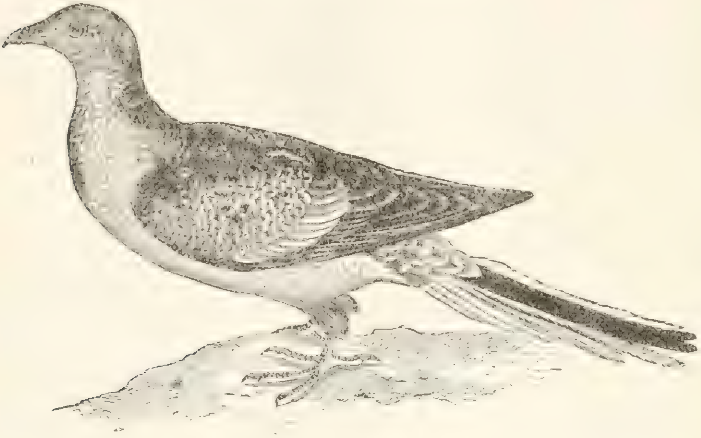
Once very common; "none observed in Upper Peninsula" (A. H. Boies); formerly large flocks were seen on the college farm; now extinct except north; "extinct in Montcalm Co." (Prof. James Satterlee); "I do not believe there is a turkey north of an east and west line passing through Houghton Lake" (Dr. M. L. Leach); "common in Bay City markets ten years ago, now rarely seen, a half dozen or so taken in Tuscola Co. in 1889" (N. A. Eddy); "once very common, but of late has become extinct, or has been driven to other parts" (W. A. Oldfield); all seasons of the year; breeds; nests in May, on the ground; eggs nine to twelve, occasionally as many as eighteen, creamy white, spotted with brown; "eggs creamy white thickly spotted with small specks of rusty brown and umber" (H. Nehrling); excellent for table; Jerome Trombley reports an old bird, with brood, in Monroe Co., in 1888; J. B. Purdy writes me that young were taken in Wayne in 1888, and eggs in Kent Co. in 1891. It is an interesting fact that this species is omitted in the excellent list of the late Dr. A. Sager. A number of fine turkeys were caught here a few years ago in a log pen into which they passed through a hole dug in the ground, underneath one side, as they picked up corn which was placed in this trench. Once in the pen, they only looked up, and so they were successfully caged.

ORDER COLUMBÆ. PIGEONS.

FAMILY COLUMBIDÆ. PIGEONS AND DOVES.

These birds are granivorous, as well as insectivorous.

GENUS ECTOPISTES SWAIN.



Wild Pigeon, reduced.

141-315-(543). Ectopistes migratorius (*Linn.*). *WILD PIGEON; PASSENGER PIGEON.

Once very common, now equally rare; as a boy I saw immense flocks in Shiawassee Co., so large as to nearly cloud the sky; we used to catch them by use of a net, hundreds at a time; "my father tells me that they were once so common here, Port Sanilac, that they were killed by poles and carried home in wheel barrows, they would darken the sun for hours as they flew over. Now very rare. I killed one in 1889 and saw one in 1890" (W. A. Oldfield); "became extinct at Ann Arbor about 1875" (Dr. J. B. Steere); "I have seen flocks of from 30 to 80 in Kent Co." (S. E. White); "became extinct in Monroe Co. in 1885" (Jerome Trombley); "last seen at Morrice in 1881, when I shot 52" (Dr. W. C. Brownell); "last seen at Albion in 1885, when one was taken by L. J. Griffin" (O. B. Warren); reported from Benzie and Presque Isle Counties; "Mackinac Island" (Dr. M. Gibbs); "large flocks occasionally seen on Mackinac Island" (S. E. White); "seen at Keweenaw Point as early as May 4" (Kneeland); March to Oct., sometimes taken in winter; formerly bred in all parts of the state, abundantly north; large breeding roosts formerly at Shelby, Mich. (Forest and Stream, Vol. XIV, pp. 231, 232); Mr. C. J. Foreman tells me that they nested in Emmet Co. about 1878 in exceeding numbers, when the nests covered many acres, and as they left their nests, they would darken the sun, as by a cloud; nest and eggs similar to those of the next species, except that this one nests in colonies and "lays one egg at a sitting" (Dr. M. Gibbs); valuable for table, destroys grain. For interesting description of this bird in Michigan see article by Mr. William Brewster, in Auk, Vol. VI, Oct. 1889, p. 285; and for description of its breeding and migration in Michigan, see article in Scientific American, Vol. XLII, 1883, p. 343.

GENUS ZENAIDURA BONAP.

Carolina Dove, natural size.

142-316-(544). Zenaidura macroura (*Linn.*). *MOURNING DOVE; CAROLINA DOVE.

Very common; throughout the state; found in all months, but rare in winter; during this very cold winter of 1892-3 several of these birds have been seen daily about my corn crib; "rare at Mackinac Island" (S. E. White); "common on Keweenaw Point" (E. W. Durfee); "from May to Sept." (J. B. Purdy); "very common at Port Sanilac at all seasons, and breeds abundantly" (W. A. Oldfield); breeds; nests in May—R. H. Wolcott found a nest July 18, 1892—in low bushes, in low trees in orchards, on fences, rarely on the ground, often close to house, while the pigeon prefers dense woods; eggs two, white. These birds are often seen along the roadside and in barnyards.

ORDER RAPTORES. BIRDS OF PREY.

Strong, carnivorous, with hooked beaks and strong talons.

SUBORDER SARCORHAMPHI. AMERICAN VULTURES.

FAMILY CATHARTIDÆ. AMERICAN VULTURES.

Birds of prey and carrion eaters; valuable as scavengers.

GENUS CATHARTES ILLIGER.

143-325-(537). Cathartes aura (*Linn.*). TURKEY VULTURE; TURKEY BUZZARD.

Very rare; E. L. Moseley, who has lived twenty summers in Branch Co., has never seen one in Michigan; F. M. Falconer writes me "not very rare in the spring of 1892, at Hillsdale;" "throughout the state" (A. H. Boies); embraced in Fox's list of 1853 of "Birds about Detroit;" J. S. Tibbitts writes in 1874, "common in early days but never seen now;" Mr. L. W. Watkins tells me that they are common in

Jackson and Washtenaw counties every year; they are never seen here; Dr. Atkins makes no mention of them; C. J. Davis, Lansing, Michigan, has one in his collection, taken at Fowlerville, Livingston Co.; "becoming more common each year" (Dr. M. Gibbs); Prof. J. W. Simmons has taken them in Van Buren Co.; Geo. D. Sones, of Fresno, California, writes me that he took them at Ross, Kent Co., in 1886 and 1887; Mr. N. A. Eddy feels confident that he saw, May 7, 1889, a flock of fifteen or twenty at Bay City; "more common than formerly in Wayne Co." (J. B. Purdy); "rare in Monroe Co., where a nest with two young was taken at Petersburg in June, 1890" (Jerome Trombley); "Mr. Elmer Durfee took female and two eggs in Allegan Co. in 1891 in the large end of a hollow tree in a swamp (Dr. W. C. Brownell); "breeds in Wayne and Kent Co." (J. B. Purdy); "occasional in Kent Co., two eggs were taken by me in 1891, in Allegan Co., the only ones taken in the state" (S. E. White).

SUBORDER FALCONES. VULTURES; FALCONS; HAWKS, ETC.

FAMILY FALCONIDÆ, VULTURES; FALCONS; HAWKS, ETC.

Diurnal birds of prey; feed on mice, insects and other birds; like the owls, beneficial, as determined by extensive research by United States government investigators; most of the species feed almost exclusively on mice and insects; (See "Hawks and Owls of United States in their Relation to Agriculture," by Dr. A. K. Fisher, Department of Agriculture, Washington, 1893); eggs like those of owls, nearly spherical, usually specked.

SUBFAMILY ACCIPITRINÆ. KITES; BUZZARDS; HAWKS, ETC.

GENUS ELANOIDES VIEILL.

144-327-(493). Elanoides forficatus (*Linn.*). SWALLOW TAILED KITE.

Said to occur in Michigan; probably an accidental straggler, as the bird is a great wanderer; reported in our fauna by the late D. D. Hughes; a pair shot in Monroe Co., June 19, 1882 (See Bulletin of Nuttall Ornithological Club, Vol. VIII, Oct., 1882, p. 250). The late Mr. Collins secured a specimen near his home in Detroit.

GENUS ELANUS SAVIG.

145-328-(492). Elanus leucurus *Vieill.* *WHITE-TAILED KITE; BLACK-SHOULDERED KITE.

Very rare; Dr. H. A. Atkins reports taking it at Locke, Ingham Co.; Mr. S. E. White writes me that he took one in Kent Co., April 10, 1888, and has the specimen; Mr. A. B. Covert reports taking two specimens in Washtenaw Co., "extremely doubtful, are the specimens preserved?" (A. K. Fisher).

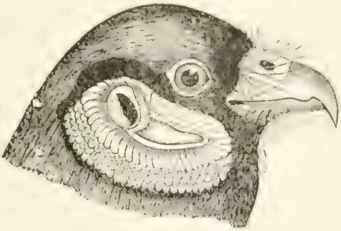
GENUS ICTINIA VIEILL.

146-329-(491). Ictinia mississippiensis (*Wils.*). MISSISSIPPI KITE.

Said to occur in Michigan; exceedingly rare; the late Hon. D. D. Hughes reported one specimen from Cass Co.; Prof. A. W. Butler gives it as a rare visitor in Northern Indiana.

GENUS CIRCUS LACEPEDE.

147 331 (489). Circus hudsonius (*Linn.*). *MARSH HAWK; MOUSE HAWK; HARRIER.



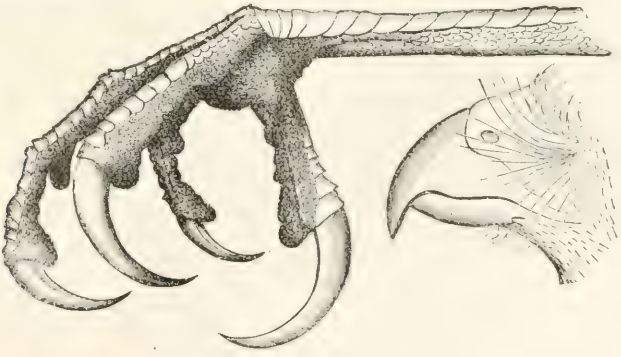
Ear parts of Circus.

Abundant; throughout the state; summer resident; "common in Monroe Co." (Jerome Trombley); "very common summer resident at St. Joseph and Albion" (O. B. Warren); "common migrant in August at Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); breeds; E. W. Durfee reports taking the eggs in Wayne Co.; nests on ground; "quite common at Port Sanilac, where I have found it breeding in nests in low shrubs in marshes" (W. A. Oldfield); eggs three to six, greenish white, often spotted with brown. We have taken the nests and young at this place. "This valuable bird should be protected by law" (J. B. Purdy).

GENUS ACCIPITER BRISS.

148-332-(494). Accipiter velox (*Wils.*). *SHARP-SHINNED HAWK.

Common; throughout the state; April to August; occasional in winter; "Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); "common migrant at Mackinac Island" (S. E. White); "very common at Albion and St. Joseph, and common at Palmer" (O. B. Warren); probably breeds; Dr. M. Gibbs writes me that it is not known to breed in Kalamazoo Co.; "common at Port Sanilac, where it is said to breed, but I have never found a nest" (W. A. Oldfield); nests in trees high up from the ground; eggs three to five, rarely seven; "a single bird has been known to lay seventeen eggs in succession" (A. W. Butler), bluish or greenish white, spotted at large end with brown. This is one of our most common small hawks, it is brave and takes toll of the fancier; "this and the following species are the only two common hawks that are injurious" (Dr. A. K. Fisher); "too small I think to be classed as a chicken hawk" (Prof. Ludwig Kumlein); "I have seen it kill chickens" (S. E. White).



Cooper's Hawk, natural size.

149 333-(495). Accipiter cooperi (*Bonap.*). *Cooper's Hawk; Chicken Hawk.

Very common; throughout the state; May to October; E. L. Moseley shot one at Grand Rapids, March 27. 1886; "common at Port Sanilac, where it is said to breed, though I have never taken a nest" (W. A. Oldfield); "common migrant at Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); breeds; nests in May in trees; "took set of five eggs at Plymouth, April 24, 1892" (J. B. Purdy); "breeds commonly in Kent Co." (S. E. White); F. M. Falconer took two eggs from a nest in the spring of 1892, and later took five from the same nest; "K. R. Willhelm of Kalamazoo climbed to nine nests from twenty to forty-five feet high in one day and secured twenty-three eggs" (Dr. M. Gibbs); "the common Hen Hawk and an enemy at St. Joseph and Albion" (O. B. Warren); eggs two to six, undistinguishable from those of the Marsh Hawk; free to visit poultry yards. I have known one to dart down and carry off a chicken within a rod of where I stood; Dr. A. K. Fisher, than whom there is hardly better authority writes me: "The true Hen Hawk, quite injurious, destroys pigeons and poultry, probably the only harmful hawk." Prof. A. W. Butler writes me to the same effect. It is sometimes known as Blue Hawk, Blue Darter (South) and Blue-tailed Hawk.

150-334-(496). Accipiter atricapillus (*Wils.*). American Goshawk.

Occasionally seen in summer; more frequently in winter; more common north, where it breeds; Dr. M. Gibbs writes me that it surely breeds in Wexford Co.; one in our museum from Berrien Co.; "rare at Albion" (O. B. Warren); "young male taken at Heisterman's Island, Saginaw Bay, August 6, 1888" (N. A. Eddy); taken by A. H. Boies in Hillsdale Co., and by S. E. White in Kent Co., and seen by him at Mackinac Island; one killed north by Elmer Durfee; Mr. Levi Broas has a fine one in his collection taken by him in Ionia Co; "this and the two preceding species are the most harmful of the hawks, the others rarely prey upon poultry" (Prof. J. A. Allen).

Genus BUTEO Cuv.

Red-tailed Hawk, natural size.

151-337-(516). Buteo borealis (*Gmel.*). *RED-TAILED HAWK; RED-TAILED BUZZARD; HEN HAWK.

Very common; throughout the state; "common at Port Sanilac where it nests in April" (W. A. Oldfield); "Iron Mountain" (E. E. Brewster); "rare summer resident at Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); this and the next species are among our most common hawks; "this species and the Red-shouldered are very valuable in destroying noxious rodents and insects and when hard pressed, take a few of the less active fowls" (Dr. A. K. Fisher); seen soaring high up in the air; "less common than the next species at Morrice" (Dr. W. C. Brownell); found at all months, "but not common in winter, indeed much less so than the next species" (E. L. Moseley); "a very common friend at Albion and St. Joseph, and not rare at Palmer, Marquette Co." (O. B. Warren); breeds; Mr. K. R. Willhelm has taken over 150 eggs in Kalamazoo Co. in four years; nests in March and April, in high trees; nest very large; eggs two to four, white, often soiled, nearly always spotted with reddish brown.

152-339-(520). Buteo lineatus (*Gmel.*). *RED-SHOULDERED HAWK; RED-SHOULDERED BUZZARD; HEN HAWK.

Very abundant; throughout the state; March to Sept.; occasionally in winter; "abundant at Albion and St. Joseph" (O. B. Warren); "common and breeds at Port Sanilac" (W. A. Oldfield); "usually rare. but occasionally a common summer resident at Mackinac Island" (S. E. White); "more common than the last species at Bay City" (N. A. Eddy); general and nesting habits and eggs much as in the preceding species except the eggs are a trifle smaller and more coarsely specked; B. H. Swales has taken a set of five eggs; K. R. Willhelm has robbed over ninety nests in Kalamazoo Co. Dr. A. K. Fisher states that both of these species are our friends; Prof. Ludwig Kumlein writes me that this and the last species rarely take poultry if they ever do.

153-342-(523). Buteo swainsoni (*Bonap.*). SWAINSON'S HAWK.

Exceedingly rare; one killed by A. H. Boies in Hillsdale Co.; one killed in Genesee Co., where it was identified by Dr. M. Miles (Miles' Birds of Michigan, p. 231); "I have never seen or heard of it in Monroe Co." (Jerome Trombley); "the food of this bird is largely composed of locusts" (L. S. Foster).

154-343-(524). Buteo latissimus (*Wils.*). BROAD-WINGED HAWK.

Common; summer resident; "common at Ann Arbor" (Dr. J. B. Steere); "Hillsdale and Lenawee Counties" (A. H. Boies); "a retired bird. found only in deep woods" (Dr. M. Gibbs); E. E. Brewster thinks this species rather common at Iron Mountain; "one seen at Mackinac Island September 1, 1889" (S. E. White); breeds; Dr. Gibbs took the eggs near Kalamazoo, May 27, 1875; nests and eggs taken by Jerome Trombley at Petersburg, in Monroe Co., where it is not uncommon; S. E. White writes that he took nest and four eggs in Kent Co., June 25, 1891; Dr. A. K. Fisher writes that it destroys myriads of locusts. "These hawks sometimes occur in flocks of several hundred during autumnal migrations" (Prof. Ludwig Kumlein); "have taken two birds but no nest at Port Sanilac" (W. A. Oldfield).

GENUS ARCHIBUTEO BREHM.

155 347a (525). Archibuteo lagopus sancti-johannis (*Gmel.*). *AMERICAN ROUGH-LEGGED HAWK.

Rare; Sept. to May; Dr. Atkins reports finding a nest in Locke, May 18, 1876, which was doubtless an error; "they do not breed in the United States" (Dr. A. K. Fisher); "one specimen taken at Plymouth in fall of 1892" (J. B. Purdy); "one taken by Mr. Dempel, of Hillsdale, April 7, 1892" (F. M. Falconer); "quite common at St. Joseph, but rare at Albion" (O. B. Warren); "Mackinac Island and Kent Co." (S. E. White); "Keweenaw Point" (Kneeland); "Iron Mountain Oct. 20, 1892" (E. E. Brewster); "rare and only in winter in Monroe Co." (Jerome Trombley); Prof. Ludwig Kumlein of Milton College, Wisconsin, writes me that he has taken one nest in Dane Co., Wisconsin, and one other nest in that state with two young in it, but he thinks this species not a regular breeder in the limits of the United States. This species is embraced in Dr. A. Sager's list of 1839. "Feeds almost entirely on small rodents" (Dr. A. K. Fisher).

GENUS AQUILA BRISS.

156-349-(532). Aquila chrysaetos (*Linn.*). GOLDEN EAGLE.

Rare; one in our museum taken in Clinton Co, and one from Northern Michigan; "taken occasionally in Southern Michigan, a rare straggler from the north" (Dr. M. Gibbs); one taken in Kalamazoo Jan. 1, 1892 (R. F. Judson in O. and O., Vol. XVII, 1892, p. 9); A. H. Boies reports it from the Upper Peninsula and from Hillsdale Co.; "not common in the Gogebic region" (H. Nehrling); Jerome Trombley has seen it at the mouth of the Raisin River in Monroe Co." "taken in Kalamazoo Co." (Dr. M. Gibbs); probably nests in the northern part of the state.

GENUS HALIÆETUS SAVIG.

Bald Eagle, reduced.

157-352-(534). Haliæetus leucocephalus (*Linn.*). *BALD EAGLE.

Not rare especially in the uninhabited regions of the north; "rare in Monroe Co., but a pair have their nest on the Raisin River near its mouth" (Jerome Trombley); all months of the year; two in our museum killed in January, one from Ingham and the other from Shiawassee Co.; found common at Bay City by N. A. Eddy (O. and O. Vol. IX, p. 4); "one old pair has nested for past twelve or fifteen years in same patch of woods, seven miles north of Port Sanilac. If tree with nest falls they build in another" (O. W. Oldfield); "Grand Traverse Co." (Dr. M. L. Leach); N. A. Eddy is satified that it breeds on the islands of Saginaw Bay; "common in the Upper Peninsula" (S. E. White); "rare now, but said to be quite common at St. Joseph previous to 1870, though now common at Palmer, Marquette Co. where it breeds and is frequently taken in traps" (O. B. Warren); "quite common in the Gogebic region of the Northern Peninsula" (H. Nehrling); breeds; "a pair of young taken from nest at Byron in spring of 1892" (J. B. Purdy); "breeds in Cheneaux Island, Mackinaw Straits" (Dr. M. Gibbs); "breeds on Keweenaw Point" (Kneeland); nests in tall trees, "using the same nest year after year" (C. J. Davis); eggs two, rarely three, nearly spherical, dirty white. The late Prof. W. K. Kedzie secured two of the young here in 1868, which he reared to maturity; "I have caught them alive in steel traps mounted on top of poles" (S. E. White). We have only these two eagles in the United States. The young differ so widely from the adult that many suppose that we have several species.

SUBFAMILY FALCONINÆ. FALCONS.

GENUS FALCO LINN.

158-354a-(498). Falco rusticolus gyrfalco (*Linn.*). *GYRFALON; JERFALCON.

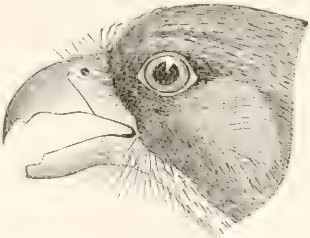
"Said to have been taken in the state in winter" (Gibbs' Birds of Michigan); "probably on Keweenaw Point" (Kneeland); "south to the United States in winter" (Jordan). Dr. Gibbs writes me that he should retain this, as his authority was the late Dr. G. B. Wilson.

159-356-(503). Falco peregrinus anatum (*Bonap.*). *DUCK HAWK; PEREGRINE FALCON.

Rare; taken by Dr. Atkins at Locke, Nov. 2, 1881; throughout the state; "rare at Ann Arbor" (Dr. J. B. Steere); "one specimen taken in Monroe Co. in 1886" (Jerome Trombley); "two Michigan specimens in the collection of the Kent Scientific Institute at Grand Rapids" (E. L. Moseley); Davie says it has been known to breed in Michigan; rather common northward, and doubtless found in spring, summer and fall but not in winter; "breeds at Michigamme" (Davie, p. 187); "breeds on southern shore of Lake Superior" (Prof. Ludwig Kumlein). This species is given in Sager's list of 1839.

160-357-(505). Falco columbarius *Linn.* *PIGEON HAWK.

Rare; throughout the state; "occasional at Ann Arbor" (Dr. J. B. Steere); all seasons, or at least a summer resident; "taken at Grand Rapids" (E. L. Moseley); "Monroe Co., rare" (Jerome Trombley); "Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); taken by Mr. A. H. Boies in Hillsdale Co., where he has seen several; taken by Dr. Atkins in February, March and April; "breeds" (Dr. M. Gibbs); "a taxidermist at Forestville, Sanilac Co., reports taking a set of five eggs, spring of 1893, I have doubts" (W. A. Oldfield); "breeds in Northern Peninsula" (Prof. Ludwig Kumlein); "may breed in northern counties, but even this is doubtful" (Prof. J. A. Allen).



Sparrow Hawk, natural size.

161-360-(508). Falco sparverius *Linn.* *AMERICAN SPARROW HAWK.

Very abundant; "rare at Bay City" (N. A. Eddy); throughout the state; April to September; "exceedingly abundant, the most common hawk at Palmer, and very common at St. Joseph and Albion where it makes havoc with Junco in late fall and spring, and eats myriads of locusts in late summer and early autumn" (O. B. Warren); "common migrant at Mackinac Island where they are seen from the middle of August to the middle of September" (S. E. White); "Keweenaw Point" (Kneeland); "occurs at Iron Mountain, Upper Peninsula" (L. W. Watkins); "very common at Iron Mountain" (E. E. Brewster); "common and breeds, I find three to five eggs" (W. A. Oldfield); breeds; nests in holes in trees which are usually decayed; eggs four to seven, nearly spherical; reddish white, spotted with brown; a beautiful, but bold "and useful friend" (A. K. Fisher); kills immense numbers of mice and insects, and occasionally birds and chickens; "lives chiefly on insects" (Prof. J. A. Allen); "I doubt if this bird ever kills chickens" (Prof. Ludwig Kumlein); "I have never seen it kill a chicken, it should be protected by law" (J. B. Purdy).

SUBFAMILY PANDIONINÆ. OSPREYS.

GENUS PANDION SAVIG.

162-364-(530). Pandion haliaëtus carolinensis (*Gmel.*). *AMERICAN OSPREY; FISH HAWK.

Rather rare; "not rare at Ann Arbor" (Dr. J. B. Steere); "rare in Monroe Co. but breeds near the lake" (Jerome Trombley); "a taxidermist at Forestville has a mounted specimen which he took there" (W. A. Oldfield); throughout the entire state; bird and young taken at the college in 1868; taken by Dr. Atkins at Locke, April 5, 1872; "occasional in the northern counties about the inland lakes" (C. E. Davis); "only seen at Plymouth in fall and winter, saw three at one time on an apple tree, February, 1892" (J. B. Purdy); in manuscript list of Fox; "tolerably common at Heisterman's Island in Saginaw Bay, where I am confident it nests" (N. A. Eddy); "common on Mackinac Island, several seen every day" (S. E. White); "common at Les Cheneaux Islands" (E. B. Boise); "Iron Mountain" (E. L. Brewster); "Keweenaw Point" (Kneeland); breeds; nests in trees, on the ground, on rocks, etc.; nests often very bulky, eggs two to four; food fish.

SUBORDER STRIGES. OWLS.

FAMILY STRIGIDÆ. BARN OWLS.

Feed on rats, mice, insects and birds; very valuable.

GENUS STRIX LINN.

163-365-(461). Strix pratincola *Bonap.* AMERICAN BARN OWL.

"Rather rare, resident" (Gibbs' Birds of Michigan); we have never seen it here; Dr. J. B. Steere informs me that the same is true at Ann Arbor; "Sault Ste Marie" (Chas. Bendire, Smithsonian Contribution to Knowledge, Vol. XXVIII, p. 325); one Michigan specimen reported in the catalogue of the Kent Scientific Institute by E. L. Moseley, who writes me that though common at Sandusky, Ohio, they are exceedingly rare in Michigan; "I have one mounted specimen taken here at Port Sanilac in 1890" (W. A. Oldfield); recorded by A. H. Boies in 1875, A. B. Covert in 1878 and by Dr. M. Gibbs in 1879; "has been known to breed in Tippecanoe and Clinton Counties, Indiana" (A. W. Butler).

FAMILY BUBONIDÆ. COMMON OWLS.

Nocturnal birds of prey; feed on rats, mice, insects and birds; do great good. Elaborate investigations by government experts prove them to be exceedingly valuable. (See "Hawks and Owls of the United States in Relation to Agriculture," by Dr. A. K. Fisher, Department of Agriculture, Washington, 1893). Eggs, like those of hawks, short and spherical. "All owls, with the possible exception of the great horned owl, and nearly all hawks should be protected by law" (J. B. Purdy).

GENUS ASIO BRISS.

Raptorial foot of an Owl.

164-366-(472). Asio wilsonianus *(Less.).* *AMERICAN LONG-EARED OWL.

Rather rare; all seasons; "not rare at Albion" (O. B. Warren); "found in Hillsdale" (F. M. Falconer); A. H. Boies has taken several in Hillsdale Co.; "at Ann Arbor" (Dr. J. B. Steere); "only seen at Plymouth in fall and winter" (J. B. Purdy);

"taken several at Port Sanilac in last few years, where it breeds, generally four pure white eggs" (W. A. Oldfield); "rare in Kent Co. where it breeds" (S. E. White); "is common and breeds in Monroe Co." (Jerome Trombley); breeds; "nests with five eggs taken in Wayne Co. in April and May" (B. H, Swales); "several nests taken about Kalamazoo" (Dr. M. Gibbs); nests bulky, in trees; "often lays in nests of other birds" (Samuels); eggs three to six, sometimes seven; we have taken this owl and its nests and eggs here at the college; Dr. Atkins took a specimen at Locke; one taken near Owosso November 25, 1892; "this is an efficient mouser" (A. K. Fisher).

165-367-(473). Asio accipitrinus (*Pall.*). SHORT-EARED OWL; PRAIRIE OWL.

Rather rare; "common in Hillsdale Co." (F. M. Falconer); occasionally "taken at Albion at all seasons" (O. B. Warren); "not rare at Ann Arbor" (Dr. J. B. Steere); "not so common as the preceding but breeds" (W. A. Oldfield); "taken not infrequently in Lenawee and Hillsdale Counties" (A. H. Boies): "Kent Co." (S. E. White); all seasons; breeds; "nests on the ground" (Samuels). We have taken one of these birds here at the college. Dr. Atkins does not report it.

GENUS SYRNIUM SAVIG.

Barred Owl, reduced.

166-368 (476). Syrnium nebulosum (*Forst.*). *BARRED OWL; HOOT OWL.

Very common; throughout the state; found at all seasons; "very common at St. Joseph and Albion, where I have often seen it flying on dark cloudy days, and rather common at Palmer, Marquette Co." (O. B. Warren); "common and breeds at Port Sanilac" (W. A. Oldfield); "Grand Traverse Co." (Dr. M. L. Leach); "common at Bay City, where one was taken on a principal street" (N. A. Eddy); "our most common owl" (Geo. D. Sones); "Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "common at Iron Mountain" (E. E. Brewster); breeds; nests in holes in trees in March and April; eggs three, white, spherical; "Mr. E. W. Durfee has taken eggs from same nest for three years, the earliest March 14, the latest April 4" (Dr. W. C. Brownell). Like the Great Horned Owl occasionally visits poultry houses. I think this more common than the Great Horned Owl, and, next to the Screech Owl, our most common species. Mr. A. B. Purdy finds that this owl will sit on her empty nest for some time after all eggs are taken.

GENUS SCOTIAPTEX SWAIN.

167-370-(474). Scotiaptex cinerea (*Gmel.*). GREAT GRAY OWL.

"Rare straggler from the north" (Dr. M. Gibbs); "Keweenaw Point" (Kneeland). I have never heard of this bird here. Mr. A. H. Boies informs me that he has noticed it in the Upper Peninsula. It is said to be partially diurnal. Brayton gives it as a rare winter visitant in Northern Indiana.

Genus NYCTALA Brehm.

168-371-(482). Nyctala tengmalmi richardsoni (*Bonap.*). Richardson's Owl.

This bird has been taken in Ohio, Illinois and Wisconsin, and it is very likely in our Northern Peninsula fauna; "probably in winter" (J. A. Allen).

169-372-(483). Nyctala acadica (*Gmel.*). *Saw-whet Owl; Acadian Owl.

Rare; found at all seasons; "rare now, but more common twenty years ago in Monroe Co." (Jerome Trombley); "quite rare at Port Sanilac, shot two here last winter, 1892–3, do not know of its breeding here" (W. A. Oldfield); "in swamps at Ann Arbor, rare" (Dr. J. B. Steere); "several have been taken at Albion by Mr. J. L. Griffin" (O. B. Warren); "not very rare in Lenawee and Hillsdale Counties" (A. H. Boies); reported from Mackinac Island by S. E. White; "Keweenaw Point" (Kneeland); breeds; nests in hollow stumps, etc.; "nests in Oakland Co." (W. C. Brownell in O. and O., Vol. XVI, p. 22); eggs four to seven; our smallest owl; I have this from Washtenaw and Ingham Counties. Dr. Atkins took one at Locke, Dec. 18, 1892, which weighed less than two ounces; Prof. James Satterlee has taken this bird at Greenville, Montcalm Co., Mr. S. E. White has taken it in Allegan Co., and Mr. Gilbert White has captured the downy young in Kent Co.; "breeds in Northern Indiana" (A. W. Butler).

Genus MEGASCOPS Kaup.

Screech Owl, reduced.

170-373-(465). Megascops asio (*Linn.*). *SCREECH OWL; MOTTLED OWL.

Our most common owl; "very common at Ann Arbor" (Dr. J. B. Steere); "very common at St. Joseph and Albion" (O. B. Warren); "common and breeds at Port Sanilac" (W. A. Oldfield); found all months of the year; in summer it whines and moans in shade trees about our houses, in winter we take it in out-buildings where it remains by day; "most common owl at Bay City though very few of any of the species are taken here" (N. A. Eddy); "Upper Peninsula" (A. H. Boies); "Keweenaw Point" (Kneeland); breeds; nests in May in hollow trees; eggs four to six, frequently eight, rarely nine, white, subspherical; eats insects and English Sparrows; beneficial; "food, principally mice" (Prof. Ludwig Kumlein). There are two phases of color, the gray and the brown, the gray is usually the most common, though occasionally the reverse seems true; see interesting article on its dichromatism in American Naturalist Vol. XXVII, pp. 521 and 638.

GENUS BUBO CUV.

Great Horned Owl, much reduced.

171-375-(462). Bubo virginianus (*Gmel.*). *GREAT HORNED OWL; HOOT OWL.

Very common; throughout the state; all seasons; "occurs at Republic, Upper Peninsula" (L. W. Watkins); "quite common at Port Sanilac" (W. A. Oldfield); "common in Monroe Co." (Jerome Trombley); "rare at Ann Arbor" (Dr. J. B. Steere); "common in Grand Traverse Co." (Dr. M. L. Leach); "it occurs on the main land off Mackinac Island" (S. E. White); "very common at St. Joseph and Albion, and the most common owl at Palmer, Marquette Co., and along the Escanaba River" (O. B. Warren); "Keweenaw Point" (Kneeland);

E. E. Brewster reports it from Iron Mountain; breeds; nests in February and March, in thick forests, in trees, nest of other birds, or in hollows of trees; "Frank Judson of Kalamazoo, has found many nests, sometimes with a single egg, usually two, but in rare cases three" (Dr. M. Gibbs); F. M. Falconer found a nest February 25, 1891, and the April following the Red-tailed Hawk occupied the same nest, each bird had occupied this nest in turn for years; eggs one to four, generally two or three, white, nearly spherical; two eggs taken at Plymouth, March 20, 1892, by J. B. Purdy; this owl is often taken in hen houses; it should not be confused with the Long-eared Owl, though it is often called by that name; it is nearly as common here as the Screech and common Barred Owls; "very valuable in rabbit infested districts, though sometimes troublesome in destroying poultry" (Dr. A. K. Fisher); one taken at the college May 9, 1893, had entered a poultry house and destroyed three chickens. It was a large female and had only minute eggs in the ovaries.

172-375a-(463). Bubo virginianus subarcticus (*Hoy.*). WESTERN HORNED OWL.

Rare; "without doubt, as Mr. A. B. Covert says, rare or accidental in Michigan, as it occurs in Wisconsin and Northern Illinois" (A. W. Butler). It is possible that this bird and also the Arctic Horned Owl may be taken in Northern Michigan. Coues includes in No. 463 this and the sub-species *arcticus*.

GENUS NYCTEA STEPH.

Snowy Owl, reduced.

173-376-(479). Nyctea nyctea (*Linn.*). *SNOWY OWL; WHITE OWL.

Common in winter; throughout the state; ten taken in December at South Haven by E. H. Lockwood (American Field, Vol. XXVII); "often taken at Albion and St. Joseph in winter, and occasionally, sometimes in traps, at Palmer, Marquette Co." (O. B. Warren); we have taken several at this place; unlike other owls, it is amiable in confinement; Mr. L. W. Watkins killed one at Manchester, Mich., that had pounced down on a hen in broad daylight and killed it; "common in Grand Traverse Co." (Dr. M. L. Leach); "Monroe Co. in severe winters" (Jerome Trombley); "very rare in winter, one taken in St. Joseph Co. in 1892" (A. H. Boies); "Keweenaw Point" (Kneeland); "quite common in winter at Port Sanilac, a farmer in spring of 1892 in driving through some woods, ran across a snowy owl and three young, not yet able to fly, he set his dog on them and they were killed" (W. A. Oldfield); "food, mammals, birds, batrachians, fish and molluscs" (L. S. Foster).

Genus SURNIA Dumeril.

174-377a-(480). Surnia ulula caparoch (*Müll.*). American Hawk Owl.

"Rare winter visitor" (Gibbs' Birds of Michigan); "I have one mounted specimen killed near here in 1891" (W. A. Oldfield); Mr. A. H. Boies has taken one in St. Joseph Co.; "south to Wisconsin" (Jordan). We have never seen this bird here; "Eagle River on Keweenaw Point" (Kneeland); embraced in the lists of Dr. Sager (1839). Cabot's Birds of Northern Peninsula, St. Ignace (1850). Dr. Miles (1861), and Covert's Birds of Washtenaw Co. (1881).

Order PSITTACI. Parrots; Macaws; Paroquets, etc.

Mostly tropical birds, with very hooked beaks and claws for climbing.

Family PSITTACIDÆ. Parrots.

Feed on cockle bur, tender twigs, blossoms and young fruit of the orchard trees, fruit and grain.

Genus CONURUS Kuhl.

175-382-(460). Conurus carolinensis (*Linn.*). Carolina Paroquet.

Exceedingly rare; A. H. Boies believes he saw a pair at Mallory Lake in Hillsdale Co, 1860; "remarkable and hardly possible" (Dr. M. Gibbs); Dr. Robert Ridgway informs me that the National Museum collection has a specimen labeled from Michigan. Prof. Ludwig Kumlein writes me that he has shot one specimen in Jefferson Co., Wisconsin, and that his father, the late Thos. Kumlein, saw them in Wisconsin in the forties; if it occur in Michigan it comes as a very rare straggler from the south; usually seen in flocks; for a very interesting article on this bird see Auk. Vol. IX, Jan., 1892, pp. 49-56, where Mr. A. W. Butler gives a very complete monograph on the distribution of this species. It is stated (p. 50) that both Audubon and Wilson reported this bird from Michigan, which is certainly conclusive.

ORDER COCCYGES. CUCKOOS.

These are climbing birds with curved, not hooked beaks.

SUBORDER CUCULI. CUCKOOS.

FAMILY CUCULIDÆ. CUCKOOS.

Feed on insects, even eating hairy caterpillars; very beneficial.

SUBFAMILY COCCYGINÆ. CUCKOOS.

GENUS COCCYZUS VIEILL.

Yellow-billed Cuckoo, reduced.

176–387–(429). Coccyzus americanus (*Linn.*). *YELLOW-BILLED CUCKOO.

Formerly rather rare at this place, but now quite common; "less common in Monroe Co. than the next species" (Jerome Trombley); "breeds commonly on Heisterman's Island, Saginaw Bay" (N. A. Eddy); "common in Kalamazoo Co." (Dr. M. Gibbs); S. E. White reports this species very rare in Kent Co. and one seen at Mackinac Island, July 8, 1889; "common at Albion and St. Joseph" (O. B. Warren); "I have this and the next species both taken here, I have also taken eggs of the Black-billed" (W. A. Oldfield); easily mistaken for the Black billed Cuckoo; Dr. Atkins reported finding eggs of this species in the nest of the Black-billed Cuckoo; "the time of incubation of eggs, in the same set, very variable" (S. M. Falconer); breeds; I find both this and the next species nesting commonly about the college grounds; nests in trees; eggs two to six, usually four; like those of the next species, only larger and a little lighter colored. We see that these birds are some like the European Cuckoo in the habit of using each others nests, which may account for the varying period of incubation.

177-388-(428). Coccyzus erythropthalmus (*Wils.*). *BLACK-BILLED CUCKOO.

Formerly quite common at this place, but now rather rare; May to August; "very common in Kent Co. and not uncommon resident at Mackinac Island" (S. E. White); "common on Keweenaw Point" (E. W. Durfee); "common at St. Joseph, very common at Albion, and a not rare summer resident at Palmer, Marquette Co." (O. B. Warren); "very common in Kalamazoo Co." (Dr. M. Gibbs); "both of the Cuckoos are rare at Bay City" (N. A. Eddy); Mr. Robert H. Wolcott took four nests with eggs, July 20, 1893, at St. Clair Flats; breeds; nests in June, in orchards, bushes or trees; eggs four to six, laid at intervals, blue; feed on hairy caterpillars. I have often seen them eat the Tent Caterpillar *Clisiocampa americana*. Forbes found (see report of Michigan Hort. Soc., 1891, p. 201) that seventy-five per cent of the food of birds of this species which he examined consisted of canker worms.

SUBORDER ALCYONES. KINGFISHERS.

Strong billed birds; food almost entirely fish.

FAMILY ALCEDINIDÆ. KINGFISHERS.

Feed on fish; found about streams; kill fish by using them as a hammer; utter a whirring note as they fly along the creek or river.

GENUS CERYLE BOIE.

Belter Kingfisher, reduced.

178-390-(423). Ceryle alcyon (*Linn.*). *BELTED KINGFISHER.

Very common; throughout the entire state; April to Sept.; "Grand Traverse Co." (Dr. M. L. Leach); "often common summer resident at Mackinac Island" (S. E. White); "very common at Albion and St. Joseph, and Palmer, Marquette Co., where it breeds in banks of excavated mines" (O. B. Warren); "Keweenaw Point" (Kneeland); "occasionally in mild winters in Monroe Co." (Jerome Trombley); "common all through the Upper Peninsula" (L. W. Watkins); "common at Iron Mountain" (E. E. Brewster); breeds; nests in a hole four to eight feet long in banks; "nests sometimes in hollow trees" (Dr. W. C. Brownell); "very common at Port Sanilac, where nearly every bank has a pair" (W. A. Oldfield); "rare at Bay City as the banks are low" (N. A. Eddy); nests along the banks of the Red Cedar River on the college grounds; eggs five to eight, white.

Syndactyle foot of Kingfisher.

ORDER PICI. WOODPECKERS.

Climbing birds, with chisel like bills and barbed tongues.

FAMILY PICIDÆ. WOODPECKERS.

Peck holes in wood in search of insects; food insects, fruit and grain; very beneficial; nest in holes formed in trees; eggs snow white.

GENUS DRYOBATES BOIE.

179-393-(433). Dryobates villosus (*Linn.*). *HAIRY WOODPECKER.

Very common; throughout the state; found at all seasons; "Grand Traverse Co." (M. L. Leach); "quite common at Port Sanilac, breeds" (W. A. Oldfield); "rare at Mackinac Island where it arrives late in July" (S. E. White); "Keweenaw Point" (Kneeland); "common at Iron Mountain" (E. E. Brewster); "common at Albion and St. Joseph, and very common at Palmer, Marquette Co., where it arrives the first of April" (O. B. Warren); breeds in all parts of the state, but more common north; male aids in incubation; eggs four to five, clear white; eats borers and other insects. I have made a close study of this and the following species, and I feel certain that they are of great economic value to the pomologist. The bands used in destroying coddling moth pupæ are often fairly riddled by these birds in quest of the insects which the bands conceal.

Downy Woodpecker, natural size.

180-394-(440). Dryobates pubescens *Linn.* *DOWNY WOODPECKER.

Very common; throughout the state; abundant at all seasons; "Grand Traverse Co." (M. L. Leach); "Mackinac Island, where they are the first Woodpeckers to arrive late in July" (S. E. White); "common at Albion and St. Joseph, but rare at Palmer, Marquette Co." (O. B. Warren); "common at Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); nests in June, more abundantly north; hole for nest very smooth, almost polished; eggs four to six, small, clear white. I find, almost always, in the winter and spring, the grub of the large headed borer of the Buprestid beetle, *Chrysobothrys femorata*, in the stomach of this species. This bird feeds largely on the larvæ and pupæ of the coddling moth and our numerous leaf rollers. This and the preceding species are much the same, except for size.

GENUS PICOIDES LACEP.

181-400-(443). Picoides arcticus (*Swains.*). ARCTIC THREE-TOED WOODPECKER; BLACK-BACKED THREE-TOED WOODPECKER.

Very rare south; abundant near Higgins Lake and north; "not seen at Ann Arbor" (Dr. J. B. Steere); "have seen twenty in one trip through the woods at Howard City and Cadillac" (Dr. M. Gibbs); "found common in pineries by N. A. Eddy and taken at Bay City" (O. and O., Vol. VII, p. 143); I have no account of it south of Ionia Co.; "taken not uncommonly in Grand Traverse and Roscommon Counties" (J. C. Nichols); "it is not rare at Palmer where it breeds, its call is frequently heard, and is very harsh and disagreeable" (O. B. Warren); "occasionally seen in the pine woods fourteen miles west of Port Sanilac, Sanilac Co." (W. A. Oldfield); "common in the Gogebic region" (H. Nehrling); embraced in Cabot's Birds of Lake Superior; "not rare on Upper Peninsula" (A. N. Wood in O. and O., Vol. IX, 1884, p. 62); "Keweenaw Point" (Kneeland); "common in North Michigan pineries" (Prof. Ludwig Kumlein); "common in Iron Co." (S. E. White); "not rare in Grand Traverse Co." (M. L. Leach); common on Saginaw Bay (N. A. Eddy in O. and O., Vol. IX, p. 5); one in collection of Dr. E. S. Holmes, Grand Rapids, was taken in Kent Co., and one in the fine collection of Levi Broas, Belding, was taken n Ionia Co. Without doubt this bird breeds in the northern part of this state; "I know of one instance of its breeding in Roscommon Co." (Dr. W. C. Brownell); Mr. E. E. Brewster writes me that this bird is common in winter at Iron Mountain, but he cannot say that it breeds.

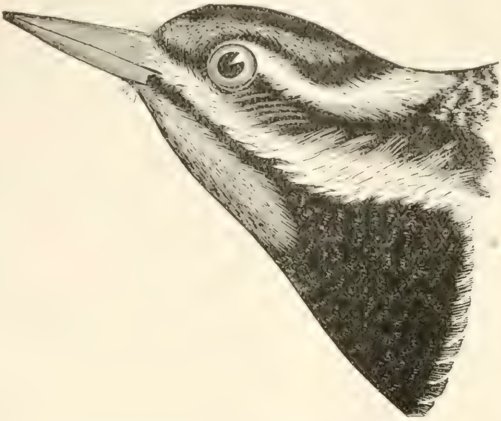
182-401-(444). Picoides americanus *Brehm.* AMERICAN THREE-TOED WOODPECKER; BANDED-BACKED THREE-TOED WOODPECKER.

Exceedingly rare; "not rare in Northern Peninsula and Gogebic region" (H. Nehrling); in Cabot's list of Birds of Lake Superior; "Keweenaw Point" (Kneeland); inserted in Gibbs' "Birds of Michigan" on the authority of A. B. Covert; "I know of no record for the state" (Dr. A. K. Fisher).

GENUS SPHYRAPICUS BAIRD.

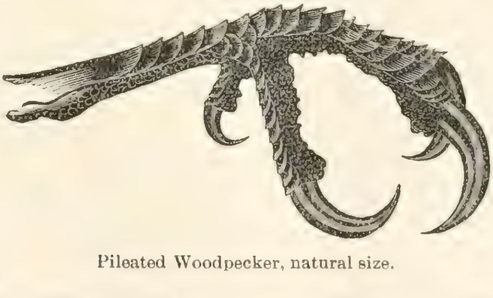
183-402-(446). Sphyrapicus varius (*Linn.*). *YELLOW-BELLIED SAPSUCKER; YELLOW-BELLIED WOODPECKER.

Quite abundant in the spring; occasional in summer; found all months from April to October; rarely seen as late as December; very common at Albion, and at St. Joseph in spring, during the maple sugar season (O. B. Warren); breeds in May and June; "often takes three weeks to peck the hole for nest, which is often found in sound ash trees" (Dr. W. C. Brownell); eggs five to seven, white; "the Sapsucker" (Butler's Birds of Indiana); "taps trees more than either the Hairy or Downy Woodpecker according to my observation" (S. E. White); Mr. White reports it as a rare migrant at Mackinac Island; "this is surely the Sapsucker par excellence at Grand Rapids" (E. L. Moseley); "I know it is a Sapsucker as I have seen it at work" (E. B. Boies); "this is the Sapsucker, not only of Indiana, but everywhere" (A. W. Butler); the old ornithologists always refer to the Downy and Hairy Woodpeckers as the Sapsuckers, and I and others believe that we have seen them sucking the sap from evergreens here on the college campus. The evidence seems overwhelming that this species is the one that makes the regular holes in pine, orchard, and especially maple trees, thus tapping them and coming again for the sap. (See Auk., Vol. 8, p. 256). Mr. E. E. Brewster writes that this is common at Iron Mountain, where he has shot it as it was taking maple sap. He says that the feathers were all sticky from the sugar on them.



Yellow bellied Woodpecker, natural size.

Genus CEOPHLŒUS Cab.



Pileated Woodpecker, natural size.

184-405-(432). **Coephlœus pileatus** *Linn.* *PILEATED WOODPECKER; BLACK WOODPECKER; LOG COCK; WOODCOCK (Michigan and Indiana).

Once common throughout the state; found at all seasons; now very rare; one seen near college in summer of 1892; "extinct at Ann Arbor" (J. B. Steere);

"not seen in Monroe Co. since 1887, though once common" (Jerome Trombley); "occasionally seen in pine woods west of Port Sanilac" (W. A. Oldfield); "rare in Kent Co." (S. E. White); "Grand Traverse Co." (M. L. Leach); "rare in the high maple woods at Mackinac Island but said to be common in winter" (S. E. White); "quite common at Palmer, Marquette Co. where it is eaten and relished by the miners who call it the 'woodcock'" (O. B. Warren); "Keweenaw Point" (Kneeland); "not uncommon at Iron Mountain" (E. E. Brewster); "Upper Peninsula where it probably breeds" (A. H. Boies); still common north, especially in the Northern Peninsula; "becoming extinct at Bay City" (N. A. Eddy); confined to thick forests; our largest Woodpecker; breeds; "L. E. Reed found a nest with eggs in May, in Van Buren Co." (Dr. M. Gibbs); eggs three to six; noise from pecking heard for long distances. Until within a few years this bird was common in the forests about the college where I have taken several.

GENUS MELANERPES SWAIN.

185–406 (453). Melanerpes erythrocephalus (*Linn.*). *RED-HEADED WOODPECKER.

Exceedingly abundant; summer resident; April, rarely March, to September; occasional in winter; "often found apparently lifeless in winter, but recovers with warmth" (Dr. W. C. Brownell); throughout the state; "very abundant and a great cherry eater at St. Joseph, Berrien Co. abundant in summer and common in winter at Albion, but not at Palmer, Marquette Co." (O. B. Warren); "rare though occasionally a common migrant at Mackinac Island" (S. E. White); "common at Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); breeds abundantly; nests as usual, often in telegraph poles; eggs five to six; often destroys much fruit, especially cherries; eats grain, especially corn, yet is our friend. Forbes found (Michigan Hort. Soc. Report, 1881, p. 204) that thirty-two per cent of the food of these birds, which he examined, consisted of canker worms. "Bred in parks at Bay City before advent of English Sparrow" (N. A. Eddy). "I have seen this bird destroy the eggs of the Bluebird and Phœbe" (S. E. White).

186–409 (450). Melanerpes carolinus (*Linn.*). *RED-BELLIED WOODPECKER.

Common, though rare, except in wooded fields; Southern Peninsula; found at all seasons; common from May to August; "occasionally seen in spring migrations at Albion and St. Joseph" (O. B. Warren); "quite common and breeds at Port Sanilac" (W. A. Oldfield); "very rare at Niles, Berrien Co." (Paul Van Riper); breeds; nests in May in holes often twenty inches deep, usually in rotten wood; eggs four to six, glossy white.

GENUS COLAPTES SWAIN.

187–412–(457). Colaptes auratus (*Linn.*). *HIGH HOLDER; FLICKER; YELLOW HAMMER; GOLDEN-WINGED WOODPECKER.

Formerly very abundant on the college campus, now less common; throughout the state; April to September; occasional at all seasons; reported from Benzie and Presque Isle Counties and Thunder Bay; "abundant migrant at Albion and St. Joseph, and very abundant at Palmer, Marquette Co.—the most common Woodpecker" (O. B. Warren); "very common in Grand Traverse Co." (M. L.

Leach); "abundant migrant at Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "thirty miles north of Mackinaw" (A. H. Wood, O. and O., Vol. IX, p. 62); "common at Iron Mountain" (E. E. Brewster); "breeds abundantly at Heisterman's Island" (N. A. Eddy); breeds abundantly; eggs glossy white, five to ten; if eggs are removed daily this bird will often lay as many as thirty, which we have proved at this place; J. B. Purdy in like way has taken twenty-seven from a nest; "feeds abundantly on ants which it takes from the ground" (E. L. Moseley); "nests in holes, often of apple trees, four to six feet from the ground" (Dr. J. B. Steere); Geo. D. Sones says that this bird is often shot for the table.

ORDER MACROCHIRES. GOATSUCKERS, SWIFTS, ETC.

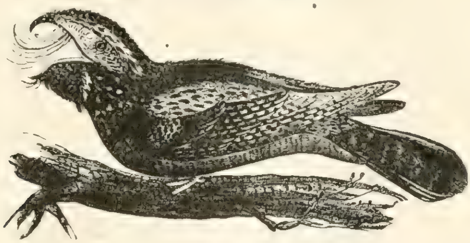
Very valuable insectivorous birds.

SUBORDER CAPRIMULGI. GOATSUCKERS, ETC.

FAMILY CAPRIMULGIDÆ. GOATSUCKERS; ETC.

Feed wholly on insects; all beneficial.

GENUS ANTROSTOMUS GOULD.



Whip-poor-will.

188-417-(397). Antrostomus vociferus (*Wils.*). *WHIP-POOR-WILL.

Common; throughout the Lower Peninsula; April to September; "common at Albion and St. Joseph, but not seen at Palmer, Marquette Co." (O. B. Warren); E. E. Brewster reports it common at Iron Mountain; "Keweenaw Point" (Kneeland); "common at Traverse City where it breeds" (L. W. Watkins); reported from Benzie and Presque Isle Counties and from Mackinac Island; "breeds at Heisterman's Island, Saginaw Bay" (N. A. Eddy); breeds; nests in June, on the ground, in slight hollows or on leaves; eggs two, grayish white, spotted with varying shades of lilac; it is well known by its note at night, which gives it its common name; this note is heard at all hours of the night and at long distances.

GENUS CHORDEILES SWAIN.

189-420-(399). Chordeiles virginianus (*Gmel.*). *NIGHT HAWK; GOATSUCKER; BULL BAT.

Very common; throughout the state; seen flying towards nightfall; May to September; "common at Traverse City" (L. W. Watkins); "rare summer resident but common migrant at Mackinac Island, where it becomes common in August" S. E. White); 'very common at Albion, St. Joseph, and Palmer, Marquette Co." (O. B. Warren); "Keweenaw Point" (Kneeland); "common at Iron Mountain" (E. E. Brewster); breeds; nests as does the last species, except it nests in open fields, and often on houses in cities; "breeds at Traverse City" (L. W. Watkins); eggs two, dirty white specked with varying shades of brown and drab; often confounded with the whip-poor-will, but has longer wings with snowy white spots

Night Hawk, reduced.

beneath, and lacks the coarse hair about the bill. Dr. Atkins reports seeing a flock with thousands of birds in August, 1868. The bird has the strange habit of darting down, when it makes a booming sound, which doubtless gave rise to one of its common names; "this bird perches lengthwise of the limb" (J. W. Simmons); Dr. J. B. Steere writes me that this highflier is often seen in cities and often commences flying early in the afternoon. He further adds that it nests on the flat roofs in the city of Detroit. Mr. J. B. Purdy writes me that this and the preceding species are becoming less abundant at Plymouth. "In the spring of 1889, many of these birds perished from starvation in Kent Co., the insects for some reason were very scarce" (S. E. White); "dates of arrival at Bay City for seven years run between May 19 and 25" (N. A. Eddy).

Suborder CYPSELI. Swifts.

Family MICROPODIDÆ. Swifts.

These birds are wholly insectivorous.

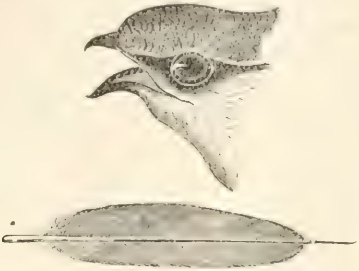
Subfamily CHÆTURINÆ. Spine-tailed Swifts.

Genus CHÆTURA Steph.

190 423 (405). **Chætura pelagica** (*Linn.*). *Chimney Swift; Chimney Swallow.

Very common; throughout the state; May to Sept.; "common at Traverse City" (M. L. Leach); I have reports that it is common at Escanaba and Bois

Blanc Island; "common summer resident at Mackinac Island" (S. E. White); "abundant at Albion, St. Joseph, and Palmer, Marquette Co." (O. B. Palmer); "common at Iron Mountain" (E. E. Brewster); breeds; two or three brooded; "usually single brooded in Ohio and Indiana" (A. W. Butler); "common on Keweenaw Point" (E. W. Durfee); nests in chimneys, rarely in hollow trees or barns, occasionally in nests of barn swallows which are first repaired, one case reported; nests made of twigs glued with a secretion formed by the bird; eggs four to six, white; feeds wholly on insects; migrates in fall, often leaving, it is reported, young birds in the nest. These birds are often considered a nuisance in houses having large chimneys; "dates of arrival for seven years at Bay City are between April 26 and May 18" (N. A. Eddy).

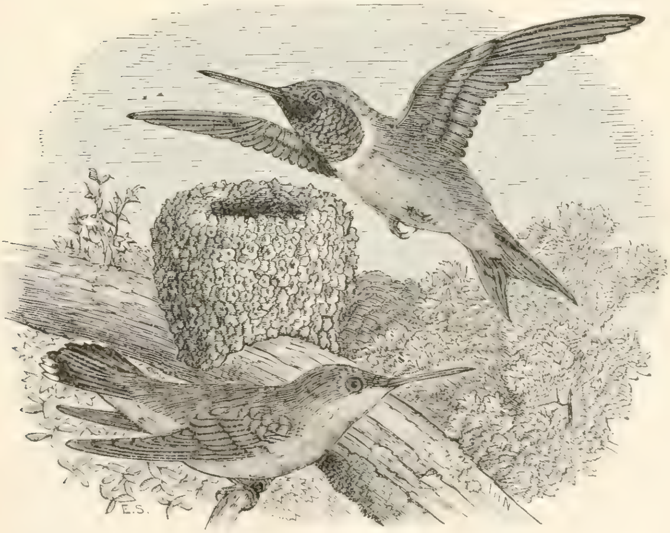


Head and mucronate tail-feather of Chimney Swift, reduced.

SUBORDER TROCHILI. HUMMINGBIRDS.

FAMILY TROCHILIDÆ. HUMMINGBIRDS.

GENUS TROCHILUS LINN.



Ruby-throated Hummingbird, male and female and nest, slightly reduced.

Wholly American; chiefly from Central and South America; about five hundred species; food, insects and nectar from flowers; beautiful and valuable; Dr. M. Gibbs thinks that the food is almost wholly nectar, but I have positive proof that they are also insectivorous.

191-428 (409). Trochilus colubris *Linn.* *RUBY-THROATED HUMMINGBIRD.

Abundant; throughout the state; common at Traverse City and Harbor Springs; "abundant at Albion and St. Joseph, but rare at Palmer, Marquette Co., and rare on Keweenaw Point" (O. B. Warren); "rare on Keweenaw Point, I have seen but one" (E. W. Durfee); E. E. Brewster reports it common at Iron Mountain and S. E. White a rare summer resident at Mackinac Island; I have it reported from Benzie Co., Escanaba and Bois Blanc Island; May to Sept.; breeds; beautiful nests in June on top of a branch and concealed by its beautiful cover of lichens; "Mr. Richard Westnedge, at Kalamazoo has found many nests, and says that these birds often build in straggling colonies" (Dr. M. Gibbs); eggs two, white; of six dissections, five of the stomachs exhibited many small insects" (S E. White). Mr. J. B. Purdy has taken the nest and in six days another was built on the same apple tree by the same bird and had eggs in it.

ORDER PASSERES. PERCHING BIRDS.

Birds with weak feet, usually slight bills, mostly singers.

SUBORDER CLAMATORES. SONGLESS PERCHING BIRDS.

FAMILY TYRANNIDÆ. FLYCATCHERS.

Pre-eminent insect feeders; excellent friends.

GENUS TYRANNUS Cuv.

Kingbird, reduced.

192 444 (368). Tyrannus tyrannus (*Linn.*). *KINGBIRD; BEE MARTIN; TYRANT FLYCATCHER.

Common; throughout the state; May till Sept.; I have reports of this species from Benzie and Presque Isle Counties, Thunder Bay and Escanaba; "very common at Albion and St. Joseph, and common at Palmer, Marquette Co." (O. B. Warren);

"Mackinac Island" (S. E. White); "common at Iron Mountain" (E. E. Brewster); "sometimes quite common at Keweenaw Point" (Kneeland); breeds; nests in June in orchard trees, etc.; eggs three to five, cream colored, irregularly spotted with brown; kills bees, both workers and drones; does more good than harm as it kills myriads of noxious insects and usually few bees; Mr. Robt. H. Wolcott writes me that he took a nest with young in at St. Clair Flats as late as July 23, 1890; Mr. L. W. Watkins tells me that this bird breeds at Traverse City. Prof. S. A. Forbes found (report of Mich. Hort. Soc., 1881, p. 204) that forty-two per cent of the food of several examined consisted of insects. "The King Bird formerly nested at Bay City, but is one of the victims of the English Sparrow" (N. A. Eddy).

Genus MYIARCHUS Cab.

Great Crested Flycatcher, reduced.

193-452-(373). Myiarchus crinitus (*Linn.*). *Crested Flycatcher; Great Crested Flycatcher.

Common; throughout the state; May to Sept.; "Mackinac Island" (S. E. White); rather retiring in its habits; "quite common at Albion and St. Joseph, but from its sober color and retiring habits often escapes notice" (O. B. Warren); breeds; nests in May and June, in holes in fence rails, usually in hollows of trees, or old Woodpecker holes; nests often contain cast skins of snakes as a portion of the fabric, as often noticed in our state; eggs four to six, yellowish white, scratched with purple.

Genus SAYORNIS Bonap.

194-456-(379). Sayornis phœbe (*Lath.*). *Phœbe; Pewee; Bridge Bird; House Pewee; Pewit Flycatcher.

Very common; probably throughout the entire state; "nest found under nearly every bridge in Sanilac Co." (W. A. Oldfield); "rare summer resident at Mackinac Island" (S. E. White); "Iron Mountain" (E. E. Brewster); "Keweenaw Point"

(Kneeland); "very common at St. Joseph and Albion. It uses same nest year after year, adding a little to it each season. It is one of the earliest birds to arrive from the south in the spring. It is common at Palmer, nesting in caves and pit workings" (O. B. Warren); breeds very abundantly; nests in May, under bridges or porches, in out houses, etc.; eggs four to seven, pure white occasionally with brown spots at large end; one of our best known and most familiar birds, its plaintive note is known to all.

GENUS CONTOPUS CAB.

195–459–(308). Contopus borealis (*Swain.*). OLIVE-SIDED FLYCATCHER.

Rather rare; throughout the Southern Peninsula; April to Aug.; "rare in Kalamazoo Co." (Dr. M. Gibbs); taken by Dr. M. Gibbs in Ottawa Co., May 21, 1879 (Bull. Nuttall Ornithological Club, Vol. IX, p. 186); "very common in many northern Counties" (C. J. Davis); "one specimen shot at Mackinac Island, August 15, 1890" (S. E. White); E. W. Durfee reports this from Kent Co. and rare on Keweenaw Point; nests in June, in trees; eggs three to five, as in next species except larger.

196–461–(382). Contopus virens (*Linn.*). *WOOD PEWEE.

Common; general in the state; May to October; usually in groves, but not rare about our houses; "rare summer resident, but common migrant Mackinac Island" (S. E. White); "rather rare at Palmer, Marquette Co., but very common at Albion and St. Joseph, in orchards. I once took four eggs from a nest, when the bird built another nest from the material of the old one and laid three eggs in it; I took these, when the bird built a third nest using the material of the second, and in this laid three eggs; I took these eggs, when the bird gave up and quitted the locality. Each such successive nest was more slight and less well built" (O. B. Warren); "Keweenaw Point" (Kneeland); E. E. Brewster reports it common at Iron Mountain; embraced in Cabot's Birds of Lake Superior; breeds; "breeds abundantly at Traverse City" (L. W. Watkins); nests in June though occasionally as late as July, or even August, (Robt. H. Wolcott took a nest with an egg in it at St. Clair Flats, July 23, 1893) in orchards, usually on horizontal limbs, the nests often beautifully covered with lichens, very rare about houses, one reported on ledge under the cornice of a house etc.; eggs three, creamy white, with spots of brown at the large end; very beneficial. The novice is likely to confuse this bird with the Phœbe; its note is very sweet and beautiful.

GENUS EMPIDONAX CAB.

197–463–(388). Empidonax flaviventris *Baird.* *YELLOW-BELLIED FLYCATCHER.

Not rare; "not rare during spring migration, one taken in Kalamazoo Co." (Dr. M. Gibbs); several taken at the college, May, 1893, by A. B. Cook; E. W. Durfee has taken this and *E. acadicus* in Wayne Co., where the latter breeds; "taken in fall at Heisterman's Island" (N. A. Eddy); "Iron Mountain" (E. E. Brewster); Mr. S. E. White reports this species as a rare migrant at Mackinac Island at the time of fall migration; said to breed in the northern part of the state; eggs usually four.

198-465 (384). Empidonax acadicus (*Gmel.*). *ACADIAN FLYCATCHER; SMALL GREEN-CRESTED FLYCATCHER.

Abundant; usually in thick woods; May to August; "in southern part of the state" (Prof. J. A. Allen); "common summer resident at St. Joseph; (O. B. Warren); "common at Greenville" (Prof. Jas. Satterlee); "common at Port Sanilac" (W. A. Oldfield); "common migrant at Mackinac Island" (S. E. White); breeds; nests in June at the end of limbs of trees or bushes; "nest attached to a horizontal branch of tree five to twenty feet high, in damp shady woods" (Jerome Trombley); "nests along creeks in elder bushes, and is very shy" (Dr. W. C. Brownell); eggs two to four, usually three, color as in Wood Pewee. This bird is often mistaken for the next two species.

199-466a-(385). Empidonax pusillus traillii (*Aud.*). *TRAILL'S FLYCATCHER.

Rather common; "common in some localities in Monroe Co." (Jerome Trombley); "abundant migrant at Mackinac Island, where it arrives from August 5 to 14 and departs from September 3 to 10" (S. E. White); "common and breeds in Wayne Co. and not uncommon on Keweenaw Point" (E. W. Durfee); breeds "rare at Ann Arbor" (Robt. H. Wolcott); "have found twenty-five or thirty nests for several consecutive years in Dundee Township, where they nest in willows by marshes. in communities, in fork of bush from three to six feet high" (Jerome Trombley); nests in June, usually in willows and alder bushes, beside streams; "nests in thick woods at end of beech or maple limbs" (Dr. W. C. Brownell); has not Dr. Brownell mistaken the Acadian for Traill's Flycatcher in the above notes? Such misidentifications are common in studying these birds; eggs four, indistinguishable frcm those of the Acadian Flycatcher. N. A. Eddy reports this and the next species at Bay City.

200-467-(387). Empidonax minimus *Baird.* *LEAST FLYCATCHER.

Common throughout the state; much more common here than either of the two preceding species; April till September; "common in Hillsdale Co." (A. H. Boies); several taken at the college in May, 1893, by A. B. Cook; "common in Monroe Co." (Jerome Trombley); "rare at Albion" (O. B. Warren); "common at Port Sanilac" (W. A. Oldfield); "Mackinac Island usually as a migrant" (S. E. White); "abundant in Kent and Washtenaw Counties, but rare in Wayne and on Keweenaw Point" (E. W. Durfee); "Iron Mountain" (E. E. Brewster); breeds; often double brooded; nest found in Wayne Co. by A. Durfee in 1889; nests in May, in trees in woods, occasionally in orchard and other trees, frequently close by the house; eggs four, white or creamy white. We find this species far more common here than either of the two preceding.

SUBORDER OSCINES. SONG BIRDS.

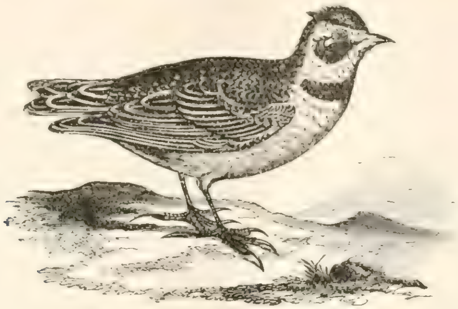
FAMILY ALAUDIDÆ. LARKS.

Insect feeders; sing on the wing.

GENUS OTOCORIS BONAP.

201-474-(82). Otocoris alpestris (*Linn.*). *HORNED LARK; SHORE LARK.

Rather rare; irregular fall and spring visitor; "late fall in Kent Co. and very common at Mackinac Island about the middle of September, where the Indians call them 'yellow throats,' and shoot them extensively for food" (S. E. White); "very common at Palmer, Marquette Co., where it is often seen with the Snow Bunting and is called 'yellow throat'" (O. B. Warren); not very rare in winter; breeds in Greenland and Labrador; often seen in barnyards, feeding on seeds, etc.; this bird is often confused with the following subspecies, which is more common in our state. From what Dr. J. B. Steere writes me, I judge that this is the more common at Ann Arbor. Mr. N. A. Eddy has taken this at Bay City.



Horned Lark, much reduced.

202-474b (000). Otocoris alpestris praticola *Hensh.* *PRAIRIE HORNED LARK.

Summer resident; Jonathan Dwight, Jr., found them at Ann Arbor and Cadillac where they were breeding (Auk, Vol. VIII, p. 138); "common at Port Sanilac" (W. A. Oldfield); "very common at Iron Mountain" (E. E. Brewster); breeds; nests on ground; in April or earlier; "breeds abundantly in Kent Co." (S. E. White); J. B. Purdy, of Plymouth, has found eggs in nest in February; nests often surrounded by snow; may be double or triple brooded; eggs four or five, gray specked with brown; food, insects and seeds. Mr. L. W. Watkins took one on eggs March 20, 1889, the nest was surrounded by snow. N. A. Eddy has seen young flying in late April at Bay City, where immense flocks are seen in fall along the bay shore. This sub-species and the preceding overlap each other in this region during winter and so are very generally confused throughout the state. The species and sub-species are thought generally to be one and the same bird.

Horned Lark, natural size.

FAMILY CORVIDÆ. CROWS, MAGPIES, ETC.

Food habits rather omnivorous.

SUBFAMILY GARRULINÆ. MAGPIES AND JAYS.

GENUS CYANOCITTA STRICKL.

203-477-(349). Cyanocitta cristata (*Linn.*). *BLUE JAY.

Very abundant; throughout the state; common in all seasons; reported from Presque Isle Co. and Bois Blanc Island; "common at Grand Traverse Co." (M. L. Leach); "abundant at Mackinac Island, where it is useful as a scavenger" (S. E. White); "not common on Keweenaw Point" (Kneeland); "common in Upper Peninsula" (A. H. Boies); "abundant resident at St. Joseph and Albion, and common at Palmer, Marquette Co., where it arrives late in March" (O. B. Warren); "common at Iron Mountain" (E. E. Brewster); breeds; nests in thick foliage, especially evergreens, very rarely in barns, one case noted; Robt. H. Wolcott also found a nest in a barn at Ann Arbor, June 8, 1893. The nest was on a cross beam and had fresh eggs in it; eggs four to five, "six" (E. Clute and D. Reynolds); light green or drab, spotted with light brown; feeds on acorns, hazel nuts, insects, fruits, young birds and birds eggs, etc.; often kills birds, especially nestlings; Dr. G. W. Topping, of Dewitt, has repeatedly seen these birds take young Sparrows and Gold Finches from their nests and then eat them; "killed a young Baltimore Oriole and took its brain, leaving the rest of the carcass" (L. W. Watkins); an English Sparrow received similar treatment from this bird on the college campus in the spring of 1893; a rather doubtful friend; note harsh; too handsome to kill. Prof. J. A. Allen informs me that he has taken a great number of the eggs of the tent caterpillar, *Clisiocampa americana*, from their stomachs in winter in Massachusetts. N. A. Eddy has seen it feeding on the entrails of an ox in the lumber camps of Northern Michigan.

GENUS PICA CUV.

204-475-(347). Pica pica hudsonica (*Sab.*). AMERICAN MAGPIE.

Said to wander to Michigan (see Youths' Companion, December, 1892); "I have seen a few specimens taken at Eagle River" (Kneeland); Butler's Birds of Indiana, p. 113; Ridgway's Manual of North American Birbs, p. 352, and Jordan's Manual of Vertebrates; "very doubtful" (Dr. A. K. Fisher).

GENUS PERISOREUS BONAP.

Canada Jay, reduced.

205-484-(359). Perisoreus canadensis (*Linn.*). *CANADA JAY.

Common from the middle of the Southern Peninsula northward; never seen in the southern part of the state; seen on our college grounds in the winter of 1893; "first seen May 17, 1876" (Dr. H. A. Atkins); it seems strange that it should occur at Locke as late as May; "never seen at Port Sanilac" (W. A. Oldfield); "common north about the logging camps" (R. H. Wolcott); A. H. Boies took a pair at Sault Ste. Marie, Oct. 20, 1892; "very abundant at Iron Co., Upper Peninsula, also in the Gogebic region" (H. Nehrling); "common at Palmer about lumber camps" (O. B. Warren); "a flock of eight were seen at Mackinac Island" (S. E. White); "common in some sections of the Northern Peninsula" (Prof. Ludwig Kumlein); "common on Keweenaw Point in winter and a pest to the trappers as it steals the poisoned bait" (Kneeland); "abundant in Grand Traverse Co." (M. L. Leach); taken by J. E. Nichols in the autumn of 1881 and 1883 in Roscommon, Kalkaska and Missaukee Counties; "common in Crawford Co., about lumber camps" (Dudley E. Waters); "common in spring and fall, but not in summer in Iron Co." (E. E. Brewster); this bird is reported to be troublesome about lumber camps, carrying off meat, etc. It doubtless breeds in the northern part of the state.

SUBFAMILY CORVINÆ. CROWS AND RAVENS.

GENUS CORVUS LINN.

206-486-(338). Corvus corax sinuatus (*Wagl.*). *AMERICAN RAVEN.

Formerly common; not rare now north; we no longer see it about Lansing; "rare but still seen at Ann Arbor" (Dr. J. B. Steere); "never seen at Port Sanilac" (W. A. Oldfield); "common at Grayling, where it nests" (Prof. L. H. Colburn); "very common on Keweenaw Point in the winter to the exclusion of the crow" (Kneeland); this may be the subspecies, *principalis* Ridg. which S. E. White states is common on the main land north of Mackinac Island (The Auk Vol. X, p. 230); "throughout the Upper Peninsula" (A. H. Boies); "common at spring and fall migrations at Palmer, Marquette Co." (O. B. Warren); "common, but very shy in Iron Co., two taken in Kent Co. April 8, 1888" (S. E. White); "common at Iron Mountain, Dickinson Co." (E. E. Brewster); "see them occasionally in Shiawassee Co. flying very high" (Dr. W. C. Brownell); "wholly gone from Greenville, Montcalm Co., where it was common thirty years ago" (Prof. James Satterlee); "common in Monroe Co., prior to 1860, before the advent of the crow" (Jerome Trombley); "rare, but I saw it some winters ago in Northern Bay and Roscommon Counties" (N. A. Eddy); J. S. Tibbits wrote in 1884 that the Raven was formerly common in Wayne Co., but is now being replaced by the crow; this bird seems to be replaced south by the crow; feeds on carrion, acorns, etc.; Dr. Gibbs writes me that he has known of its breeding in Van Buren Co., and thinks it must lay eggs as early as February. Nest and eggs much as in the next species.

207-488-(340). Corvus americanus *Aud.* *AMERICAN CROW; COMMON CROW.

Very common; throughout the state; gregarious; seen at all seasons of the year; more rare in winter; "seen first in Monroe Co. in 1860, now very common, but not in winter (Jerome Trombley); "Grand Traverse Co." (M. L. Leach); "not rare at Mackinac Island, where they are protected to do duty as scavengers" (S. E. White); "common on Keweenaw Point and in the Ontonagon District" (Kneeland);

"general in Upper Peninsula" (A. H. Boies); "common in summer at Iron Mountain" (E. E. Brewster); breeds; nests in large coarse nests in trees; eggs four to six—Dr. W. C. Brownell has a set of seven—green, blotched and sprinkled with dusky brown; eats insects, frogs, carrion, acorns, eggs of birds and poultry "especially young chickens" (O. and O., Vol. XVI, 1891, p. 61); probably our friend.

FAMILY ICTERIDÆ. STARLINGS, BLACKBIRDS, ORIOLES.

Generally insect feeders, a few eat corn, some fruit, on the whole our friends; generally gregarious; eggs usually much speckled, often marked with zigzag or broken lines.

GENUS DOLICHONYX SWAINS.

Bobolink, male, reduced.

208-494-(312). Dolichonyx oryzivorus (*Linn.*). *BOBOLINK; SKUNK BLACKBIRD; REED BIRD; RICE BIRD; BOB LINCOLN; ORTOLAN; BUTTER BIRD.

Very common; Southern Michigan; summer; May (one of the latest birds to arrive) to September; male takes the plumage of the female in the fall; beautiful singer at nesting season; not shy; breeds; nests in June, usually in meadows, on the ground; eggs five, occasionally six to seven, bluish white, marked with dark brown specks; not in Central Michigan until within a few years; I first noticed it about the college in 1874; "first in Monroe Co. in 1872" (Jerome Trombley); Dr. Atkins reports it very common in 1875, but very rare until 1874 at Locke; "first seen at Plymouth forty years ago" (J. B. Purdy); Dr. G. W. Topping says that it first appeared at Dewitt in 1881, and was numerous from the first; "common and breeds at Port Sanilac" (W. A. Oldfield); "abundant at Bay City, where it arrives from May 13 to June 1" (N. A. Eddy); "abundant summer resident at Albion and St. Joseph, but never seen at Palmer, Marquette Co." (O. B. Warren). I have reports of this bird as far north as Benzie Co., in the Southern Peninsula, and Mr. E. E. Brewster, of Iron Mountain, writes me that it occurs rarely at that place.

GENUS MOLOTHRUS SWAINS.

209-495-(313). Molothrus ater (*Bodd.*). *COWBIRD; LAZY BIRD; COW BUNTING.

Increasingly abundant; throughout the state; March to November; insect feeder; "rare migrant at Mackinac Island" (S. E. White); "abundant at Albion and St. Joseph, but rare at Palmer, Marquette Co." (O. B. Warren). "Keweenaw Point"

(Kneeland); rests on cattle and picks flies, hence name Cowbird; often in flocks; lays its eggs "extensively" (L. S. Foster) in other birds' nests, especially in nests of Grass Finch, Chipping and Song Sparrows, Orchard Oriole, Thrushes, Warblers King Bird and Pewee; Mr. A. H. Boies thinks that this bird lays only one egg in any one nest (O. and O., Vol. IX, 1884, p. 90); Jerome Trombley has taken these eggs from the nests of thirty other kinds of birds; Prof. James Satterlee has taken eggs in Greenville, Montcalm Co., from the nests of the Hermit Thrush and the Green-crested Flycatcher; Dr. Gibbs has found its eggs in the nests of the Wood Thrush, Bluebird, eight species of Warblers, Scarlet Tanager, Chewink, Traill's and Acadian Flycatchers, three species of Vireo, and five other species. R. H. Wolcott has found its eggs in the nest of Wilson's Thrush, Blue-gray Gnatcatcher, Yellow Warbler, Swamp Sparrow, Song Sparrow, Chipping Sparrow, Rose-breasted Grosbeak, Indigo Bird, Orchard and Baltimore Orioles, Wood Pewee, and once in that of the Meadow Lark; F. M. Falconer finds the eggs most frequently in the nest of the Yellow Warbler, and in two cases he has found the eggs covered over and a new set deposited; Dr. Atkins reports finding eggs in the nest of the Golden Crowned Thrush, Rose-breasted Grosbeak and Hooded Warbler; in this peculiar habit this bird is like the European Cuckoo; "usually lays eggs in nests of small birds which have a longer period of incubation, thus giving its young the first chance and 'freezing out' the rightful possessor" (C. J. Davis); S. E. White reports this bird at Mackinac Island, but only as a migrant, and E. E. Brewster writes that it is common at Iron Mountain. A male was seen daily the winter of 1892 at Alma, Michigan, with a flock of English Sparrows." "I have seen eggs walled in in Yellow Birds' nests" (Prof. C. A. Davis). A. H. Boies has given a similar case in O. and O., Vol. IX, 1884, p. 128. For interesting article on this species by Dr. M. Gibbs, see O. and O., Vol. XV, 1830, p. 5.

Cowbird, reduced.

GENUS XANTHOCEPHALUS BONAP.

210-497 (319). Xanthocephalus xanthocephalus (*Bonap.*). YELLOW-HEADED BLACKBIRD.

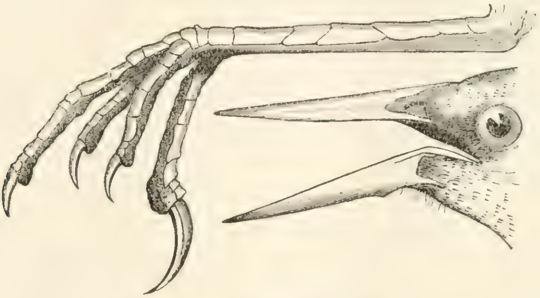
Very rare; "extreme southwestern part of the state; probably breeds" (Gibbs); "never seen at Ann Arbor" (Dr. J. B. Steere); "very doubtful if it breeds in the state" (A. H. Boies); one taken at Iron Mountain, Northern Peninsula, May 17, 1890, by E. E. Brewster; "common in Northern Wisconsin and presumably in the Northern Peninsula" (Prof. Ludwig Kumlein); "breeds in Lake Co., Indiana" (Butler's Birds of Indiana).

GENUS AGELAIUS VIEILL.

211-498-(316). Agelaius phœniceus (*Linn.*). *RED WINGED BLACKBIRD.

Exceedingly common; throughout the state; March to September; "exceedingly abundant at Albion and St. Joseph, and a rare migrant at Palmer. These occur in countless numbers in spring and fall at St. Joseph. They spend the night in the marshes and the day in the groves, etc. There is an albino in the Albion museum" (O. B. Warren); "breeds abundantly at Bay City" (N. A. Eddy); "Traverse City where it breeds" (L. W. Watkins); "rare at Port Sanilac, but common a short distance west" (W. A. Oldfield); "common at Mackinac Island" (S. E. White); "common at Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); breeds; two broods; nests in May, in grass clumps or low brushwood in marshes; nests usually surrounded by water; eggs four to five, rarely six, light blue, streaked and specked with brown or black; food insects and grain, principally corn; often seen in flocks, especially in autumn.

GENUS STURNELLA VIEILL.



Meadow Lark, natural size

212-501 (320). Sturnella magna (*Linn.*). *MEADOW LARK; MEADOW STARLING; FIELD LARK.

Exceedingly abundant; throughout the state; March to October; often seen every month in the year; "very rare visitant at Mackinac Island, where I flushed four July 12, 1889" (S. E. White); "does not occur at Iron Mountain, as I have not seen it or heard its note" (E. E. Brewster); "abundant at Albion and St. Joseph, but never seen at Palmer, Marquette Co." (O. B. Palmer); "breeds abundantly at Bay City, where it is often seen in the principal streets" (N. A. Eddy); L. W. Watkins has found it breeding at Traverse City; nests in May on the ground; eggs five to seven, white with brown spots, rarely immaculate; "often shot for game" (Geo. D. Sones).

213-501b-(322). Sturnella magna neglecta (*Aud.*). *WESTERN MEADOW LARK.

Although this is included in Covert's and Stockwell's lists, I doubt its occurrence in our state. Dr. Gibbs writes me to the same effect. Dr. Atkins states that he saw a flock September 8, 1876. Were not these immature specimens of the preceding species? Prof. J. A. Allen writes me that he thinks Dr. Atkins was mistaken in his identification. Prof. A. W. Butler identified one from Cook Co., Illinois, only two counties removed from Michigan.

GENUS ICTERUS BRISS.

214-506-(324). Icterus spurius (*Linn.*). *ORCHARD ORIOLE.

Common summer sojourner; rare about Lansing; "common in Kent Co." (S. E. White); "very common at Greenville, Montcalm Co." (Prof. James Satterlee); "common and breeds at Port Sanilac" (W. A. Oldfield), "very common in Cass Co. where it breeds in June" (J. W. Simmons); "breeds abundantly at Plymouth, and usually lays five eggs" (J. B. Purdy); taken frequently in Ionia Co. by Mr. Levi Broas; "common in Wayne Co. where it breeds" (B. H. Swales); "abundant breeder at Bay City. The male can be depended on to arrive the first week of May, it precedes the female, it is seen but is rare at Heisterman's Island, in Saginaw Bay" (N. A. Eddy); "rare but breeds at Ann Arbor" (Dr. J. B. Steere); breeds plentifully in the southern part of the State; "this and the next species breed abundantly at Albion and St. Joseph, but are not seen at Palmer, Marquette Co., this one nests in orchard trees but the green moss covering so effectually hides the nest that it is found with difficulty" (O. B. Warren); Dr. Atkins took a specimen May 25, 1892, at Locke, Ingham Co.; Robt. H. Wolcott took a nest with eggs at New Baltimore, July 20, 1893; "nests abundantly at Manchester, often in spruce trees, nests usually pendant, but shorter than the next species, woven closely to twigs and much concealed" (L. W. Watkins); eggs four to six, smaller than in the next species, and the dashes shorter.

215-507-(326). Icterus galbula (*Linn.*). *BALTIMORE ORIOLE; HANG NEST; FIRE BIRD.

Common; throughout the Lower Peninsula at least; "never seen at Iron Mountain" (E. E. Brewster); "I have never seen it at Mackinac Island" (S. E. White); May, rarely April, to August; "common at Traverse City, where it breeds abundantly" (L. W. Watkins); "common even in the City of Ann Arbor" (Dr. J. B. Steere); breeds; nests "purse-shaped" (L. S. Foster), suspended; "I have a nest constructed wholly of horse hair from mane and tail of a horse" (Prof. J. W. Simmons); Mr. O. B. Warren writes me that he has known these birds to return to the same nest year after year, and he once knew a bird to hang itself in the suspending cords of its own nest by accident; nests usually at the ends of limbs of tall trees (it often selects elms or the top-most limbs of orchard trees); eggs four to six, pinkish white or bluish white; scratched with brown; feeds on insects (will even eat the large tomato worm) and fruit; beautiful bird; sweet singer; next to the Scarlet Tanager this is the most showy of our common birds. I have seen these birds eat the young bark lice from linden trees in the spring, and have seen them driven away by the bees and wasps that come for the honey-dew.

GENUS SCOLECOPHAGUS SWAIN.

216-509-(331). Scolecophagus carolinus (*Müll.*). *RUSTY BLACKBIRD; RUSTY GRACKLE.

Abundant throughout the state; migrant; "only migrant at Ann Arbor" (Dr. J. B. Steere); "have seen flocks of this bird in fall at Port Sanilac" (W. A. Oldfield);

"common spring and fall migrant at Bay City" (N. A. Eddy); observed at Sault Ste Marie by A. H. Boies; E. E. Brewster has taken it at Iron Mountain; "saw a flock of about twenty at Mackinac Island, September 22, 1889" (S. E. White); "Keweenaw Point" (Kneeland); "probably breeds" (Gibbs' Birds of Michigan); may possibly breed in Northern Peninsula.

GENUS QUISCALUS VIEILL.

217 511b (337). Quiscalus quiscula æneus (*Ridgw.*). *BRONZED GRACKLE; BRONZED CROW BLACKBIRD; CROW BLACKBIRD; COMMON BLACKBIRD.

March to September; exceeding abundant; throughout the state; "often in cities" (Geo. D. Sones); often in immense flocks especially in spring and fall; "decreasingly common in Monroe Co." (Jerome Trombley); "seen migrating for four days through Mackinac Island in September, 1889" (S. E. White); "common at Iron Mountain" (E. E. Brewster); "in some localities in Marquette Co., as I have seen them in protected bottoms in St. Joseph in January, I think they may remain with us sometimes over winter" (O. B. Warren); breeds; nests in May and June in large coarse nests in swamps, in bushes usually near the ground -R. H. Wolcott has found them in evergreens forty feet from the ground; eggs four to six, rarely seven, light blue to light brown, streaked and specked with brown and black; feeds on insects, especially white grubs, and pulls up corn and eats corn from the ear; Prof. Jas. Satterlee once found a nest in a hole in an old dead tamarack, and R. H. Wolcott reports the same from Ann Arbor, where the nest was in an old stub standing in the river. Dr. M. Gibbs writes me that he finds such nesting common in new regions where old trees are abundant. Mr. N. A. Eddy writes me that these formerly bred in holes and crevices in trees in the Bay City parks, but are driven forth by the English Sparrow.

FAMILY FRINGILLIDÆ. FINCHES, SPARROWS, ETC.

Feed on seeds and insects; our native species all beneficial. Many species are sylvan, while others frequent the cleared fields.

GENUS COCCOTHRAUSTES BRISS.

Evening Grosbeak, reduced.

218-514-(189). Coccothraustes vespertina (*Coop.*). Evening Grosbeak.

Winter; rarely seen; occasionally very common; type specimen described by Cooper was from Sault Ste. Marie; E. E. Brewster reports a large flock at Iron Mountain in the winter of 1882; Mr. L. H. Colburn sent me one shot from a flock in Van Buren Co. in 1887; winter of 1889-90 at the college in flocks; "Ann Arbor in 1887 and 1890" (Dr. J. B. Steere); "common in spring of 1890 at Port Sanilac" (W. A. Oldfield); "very abundant at Alma and Saginaw in winter of 1889-90" (Prof. C. A. Davis); "many seen at Albion in the spring of 1886" (O. B. Warren); "I took six out of a flock of about a dozen March 1, 1889, in Wayne Co., and my father secured some at the same time from Ogemaw Co." (E. W. Durfee); "several small flocks in Monroe Co. in winter of 1889-90" (Jerome Trombley); "attracted into houses by feeding, caught and kept in cages for two years, all males and so could not breed" (L. W. Watkins); N. A. Eddy writes me that they have only been seen twice at Bay City, March, 1887 and January, 1890; Dr. M. Gibbs saw this bird in company with the Rose-breasted Grosbeak in Kalamazoo Co. in late April, 1879 (The Auk, April, 1892). For very full monograph of this bird see article by Prof. A. W. Butler in The Auk, Vol. IX, July, 1892, pp. 238-247, also "Further Notes on the Evening Grosbeak," The Auk, April, 1893, pp. 155-157. This article refers largely to observations on this species in Michigan. He shows that this bird was general in Michigan in the winter of 1890 from January to May.

Genus PINICOLA Vieill.

Pine Grosbeak, reduced.

219-515-(190). Pinicola enucleator (*Linn.*). *Pine Grosbeak.

Occasional in winter; often in large flocks; "in flocks of thousands in Jackson Co. in 1881, where they were very tame" (Dr. H. A. Atkins); "rare straggler at Albion, and common at Palmer, Marquette Co., in autumn and even to early winter" (O. B. Warren); we have one in our museum from Ionia Co., taken in January; Mr. W. A. Oldfield took one specimen at Port Sanilac in the winter of 1892; "common in Bay Co. from November, 1883, to March 10, 1884" (N. A. Eddy in O. and O., Vol. IX, p. 41); "occasionally a straggler from the north in Kalamazoo Co. in winter" (Dr. M. Gibbs); "Keweenaw Point" (Kneeland); "not uncommon at Iron Mountain and north, where I think it breeds" (E. E. Brewster); I was surprised to find but one in the large collection of Mr. Levi Broas, made in the northern part of Ionia Co.

GENUS CARPODACUS KAUP.

Purple Finch, male, reduced.

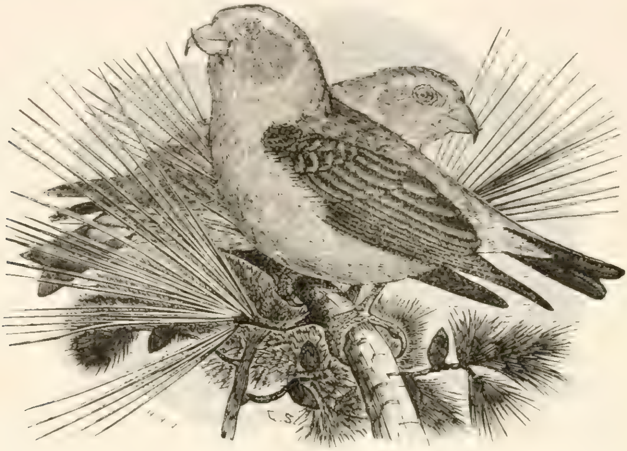
220-517-(194.) Carpodacus purpureus (*Gmel.*). *PURPLE FINCH.

Rather common; throughout the state; flocks; usually a migrant; occasional in summer; "only a migrant at Ann Arbor" (Dr. J. B. Steere); F. L. Washburn reported a flock at Ann Arbor May 24 (The Auk, Vol. VI, p. 279); "not known in Kalamazoo in summer" (Dr. M. Gibbs); "Hillsdale and Lenawee Counties" (A. H. Boies); "does not breed at Plymouth" (J. B. Purdy); "rare in Wayne Co." (B. H. Swales); "taken at Heisterman's Island in fall, and have found it common on main land at Bay Port in summer months" (N. A. Eddy); "breeds abundantly at Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "rare at Iron Mountain" (E. E. Brewster); occasionally breeds; nests in May, in trees, often close by houses; Mr. Howard B. Baker knew it to nest in an evergreen close by his father's house in Lansing; eggs four to five, very light dull green, speckled with dark spots; sweet singer.

GENUS LOXIA LINN.

221-521-(199). Loxia curvirostra minor (*Brehm*). *AMERICAN CROSSBILL; RED CROSSBILL.

Often very common; throughout the Southern Peninsula at least; winter; November to May; occasional in summer; "irregular at Ann Arbor" (Dr. J. B. Steere); "only in winter and spring at Plymouth" (J. B. Purdy); "not common in Lenawee and Hillsdale Counties" (A. H. Boies); "common in Grand Traverse Co." (M. L. Leach); "very common at Iron Mountain, think it breeds" (E. E. Brewster); F. M. Falconer reports it from Hillsdale in March and April, where a nest was found by Mr. Hempel, March 24, 1892, in a spruce, twenty feet from the ground, and one egg taken; "common at Palmer, Marquette Co., and in early spring at Albion" (O. B. Warren); "not seen at Bay City but taken in winter in Roscommon Co." (N. A. Eddy); "summer resident at Mackinac Island, where it breeds" (S. E. White); "Keweenaw Point" (Kneeland); breeds north; "I think it nests in March or earlier" (Dr. M. Gibbs); "usually February and March" (Davie, p. 289); nests in trees; eggs three to five, greenish gray, specked with brown; Dr. Atkins reports taking the nest of this bird at Locke; he also states that he has known it to peck holes in apples to secure the seeds.



Red Crossbill, male and female, reduced.

222-522-(198). Loxia leucoptera *Gmel.* *WHITE-WINGED CROSSBILL.

Often common throughout the Lower Peninsula at least; south only in winter; Dr. Atkins reports killing one at Locke, August 9, 1875; "common in Kent Co. in winter and rare summer resident at Mackinac Island" (S. E. White); "uncertain winter visitor at Ann Arbor" (Dr. J. B. Steere); "a specimen in my collection was taken at Cheboygan in winter" (N. A. Eddy); "rare at Albion, one taken February 22, 1887" (O. B. Warren); "one pair killed at Plymouth" (J. B. Purdy); "never saw it at Port Sanilac" (W. A. Oldfield); Samuel Spicer, of Genesee Co., reports finding one nesting September 28, 1888 (O. and O., p. 43, 1889); "Keweenaw Point" (Kneeland); S. E. White finds it in July and August at

White-winged Crossbill, reduced.

Mackinac Island, where it probably breeds; "breeds in Northern Wisconsin and Northern Peninsula of Michigan" (Prof. Ludwig Kumlein); this bird is a rather fine singer.

GENUS ACANTHIS BECH.

223-528-(207). Acanthis linaria (*Linn.*). *REDPOLL; COMMON OR LESSER RED POLL; REDPOLL LINNET.

Occasional winter resident; November to March or April; flocks; "irregularly abundant at Ann Arbor, there were thousands in 1888, very rare since" (Dr. J. B. Steere); "never saw it at Port Sanilac" (W. A. Oldfield); "often common in Lenawee Co." (A. H. Boies); "I have one in my collection from Cheboygan" (N. A. Eddy); "common in winter at Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); I have it reported from Thunder Bay Island; very sweet singer; feeds mostly on buds and seeds, especially seeds of the arbor vitæ.

224-528b-(208 part). Acanthis linaria rostrata (*Coues.*). *THE GREATER REDPOLL.

"Occasional straggler taken in flocks of last species" (Dr. M. Gibbs). Dr. Gibbs' specimen taken at Kalamazoo was identified by Mr. Robert Ridgway. These birds are often given as *Acanthis linaria holbœllii*, which is without doubt an error (see Butler's Birds of Indiana, p. 69).

GENUS SPINUS KOCH.

225-529-(213). Spinus tristis (*Linn.*). *AMERICAN GOLDFINCH; YELLOW BIRD; THISTLE BIRD.

Very common; throughout the Lower Peninsula; every month in the year; more common in summer; yellow in summer, darker in autumn and winter; occasional in midwinter; in fall and winter feeds on seeds; gregarious at all seasons except while breeding; but the the largest flocks occur in winter" (E. L. Moseley); "Grand Traverse Co." (M. L. Leach); "common at Albion, St. Joseph and Palmer" (O. B. Warren); "common at Iron Mountain" (E. E. Brewster); "common summer resident at Mackinac Island" (S. E. White); "not seen in Upper Peninsula" (A. H. Boies); "nests in shade tress about Bay City and seen by me in Richmond Township the present month, September" (N. A. Eddy); breeds; nests in July and August; Robt. H. Wolcott took a nest with young in it August 6, and of eggs August 13, 1893, at New Baltimore; "never before July" (R. H. Wolcott); "usually as late as July and often in August and September" (Prof. Ludwig Kumlein); we have found nests with five eggs September 10, one reported found September 28, 1888 (O. and O., Vol. XIV, 1889); nests in orchard trees and occasionally in low shrubs; eggs three to six, bluish white; Dr. H. A. Atkins and Mr. L. W. Watkins have both reared the young by putting the eggs under a common canary.

226-533-(212). Spinus pinus (*Wils.*). PINE SISKIN; PINE LINNET; PINE FINCH.

Rather rare; throughout the state; "rare at Ann Arbor" (Dr. J. B. Steere); "common in Wayne Co." (B. H. Swales); "I took one specimen at Port Sanilac in the winter of 1892-93" (W. A. Oldfield); "transient in Monroe Co., often in flocks in spring even to April and May" (Jerome Trombley); "very abundant in the pine forests north and often seen in southern counties" (Dr. M. Gibbs); winter; "rare at Albion, but common in spring and fall at Palmer, Marquette Co." (O. B. Warren); "killed from flocks at Iron Mountain. May 23. 1892" (E. E. Brewster); "Keweenaw Point" (Kneeland); "not uncommon on Keweenaw Point from early spring till late autumn, but less common in summer than in spring and fall" (E. W. Durfee); "common in winter in Kent Co., and a summer resident on Mackinac Island" (S. E. White); Dr. Atkins reports taking it in February and twice in May; "breeds in Michigan" (Davie's Nests and Eggs of North American Birds, p. 293).

Genus PLECTROPHENAX Stej.

227 534-(219). Plectrophenax nivalis (*Linn.*). *Snowflake; Snow Bunting; White Snow Bird.

Common, though fitful, not seen every winter; "I have seen it every winter with the exception of 1886, 1887 and 1891, earliest date October 16. latest March 19" (N. A. Eddy); throughout the entire state; November to March; often migrant; "Lenawee and Hillsdale Counties and common in the Upper Peninsula" (A. H. Boies); "Keweenaw Point" (Kneeland); "immense flocks at Morrice, Shiawassee Co., February, 1893" (Dr. W. C. Brownell); "occasional straggler at Albion and St. Joseph, but abundant in fall and spring at Palmer, Marquette Co." (O. B. Warren); "common at Iron Mountain from late October till snow flies" (E. E. Brewster); saw a flock of hundreds near Owosso, January, 1892. they would follow the manure wagon to gather seeds" (Bert B. Cook); "present in Kent Co. from October 28, 1890, to March 7, 1891" (S. E. White); reported from Mackinac Island; "usually does not come till snow covers the ground" (Prof. C. A. Davis).

Genus CALCARIUS Bechst.

228-536-(220). Calcarius lapponicus (*Linn.*) Lapland Longspur.

Rare; migrant; spring and autumn; often winters in Southern Michigan; "one pair killed at Plymouth" (J. B. Purdy); "occasional in winter at Port Sanilac" (W. A. Oldfield); "generally a transient visitor from the north, occasionally spends the winter south of 43° north latitude" (Gibbs' Birds of Michigan); October to April; reported from Wayne Co. and Mackinac Island; "Keweenaw Point" (Kneeland); it is said to be a common spring migrant in Northern Indiana (Butler's Birds of Indiana).

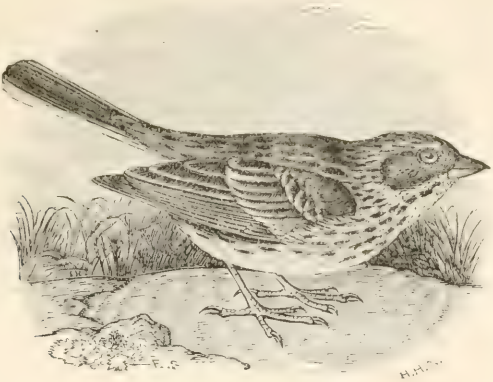
229 537-221. Calcarius pictus *Swain.* Smith's Longspur; Painted Longspur.

Reported common on the southern shore of Lake Michigan (Butler's Birds of Indiana); Dr. M. Gibbs thinks this may be found in Michigan; migrant; in flocks.

Genus POOCÆTES Baird.

230 540 (232). Poocætes gramineus (*Gmel.*). *Vesper Sparrow; Bay-winged Bunting; Grass Finch; Ground Bird.

One of our most common finches; throughout the state; April to October; "Mackinac Island" (S. E. White); "common at Iron Mountain" (E. E. Brewster); "Keewenaw Point" (Kneeland); "very common and friendly at Albion, St. Joseph and Palmer" (O. B. Warren); "next to song sparrow our most common finch" (J. Trombley); its pretty evening song—vesper song—gives it one of its common names; and this with its familiar habit, and white margined tail makes its identification easy; breeds; two or three broods a year; nests in May, June or July, on the ground in pasture, meadow and by the roadside; eggs four, gray, specked with dull brown; birds not shy; like all our native sparrows, insectivorous and valuable.

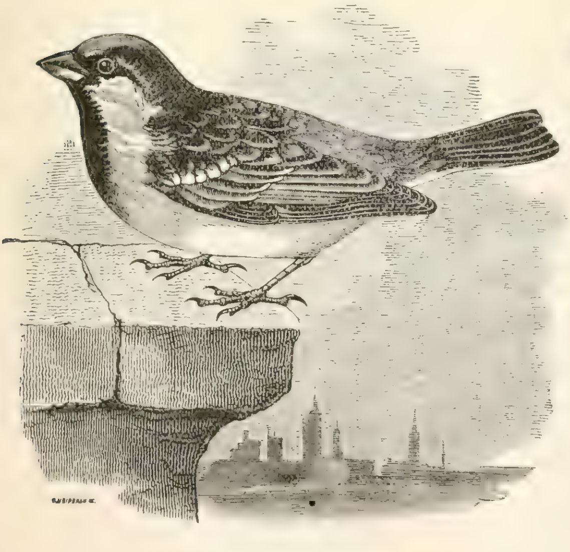


Grass Finch, reduced.

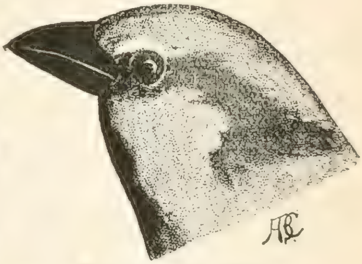
Genus PASSER Briss.

231-000-(192). Passer domesticus (*Linn.*). * English Sparrow; European Sparrow; House Sparrow; Parasite; Tramp; Hoodlum; Gammon; Philip Sparrow.

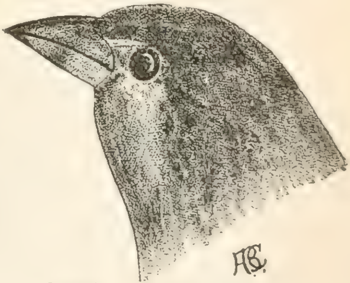
Imported species; introduced into New York in 1850; introduced into Michigan in 1879, possibly a few years earlier; first seen at the college in 1885; "first seen at Hubbardston, Ionia Co., 1885" (Prof. C. F. Wheeler); very common already throughout the Lower Peninsula; more common in towns but pushing into the country; noxious species; "like the poor, always with us at Iron Mountain" (E.



English Sparrow, male.



Male, nat. size original.



Female, nat. size original.

E. Brewster); "already at Mackinac Island" (S. E. White); eats grain, often very extensively; especially peas, vegetables and insects; drives away our native birds; is very filthy about houses; a three cent bounty is thinning its ranks, and often, though incorrect determination, the ranks of our sparrows, etc. (see bulletin No. 62, Michigan Experiment Station, or report of the Michigan State Board of Agriculture, 1890, p. 275); the amendment to the Sparrow law, made in 1893, requiring that Sparrows must be killed in winter or no bounty will be paid, removes the objection to the law; breeds abundantly; it is reported that thirty young may be reared from a single pair in a season; nests about cornices, etc., about houses and concealed places, "often in Grand Rapids in trees, the nests being bulky and open on the side" (R. H. Wolcott); eggs four or five, occasionally six, very rarely nine; soiled white, specked with brown. For full account of this bird-pest see excellent report by the United States Department of Agriculture. This bird is said to eat bots in horse droppings and so to lessen the number of botflies.

GENUS AMMODRAMUS SWAIN.

232-542a (227). Ammodramus sandwichensis savanna (*Wils.*). *SAVANNA SPARROW.

Not uncommon; migrant; Dr. Atkins took it May 10, 1882; "not sure that it breeds in Michigan" (A. H. Boies); "have taken it at Heisterman's Island in Saginaw Bay, in fall and believe it a migrant" (N. A. Eddy); "have taken one specimen at Port Sanilac, do not think it breeds" (W. A. Oldfield); "Monroe Co., but does not breed, seeing a bird in summer is not sure proof that it breeds" (Jerome Trombley); "it is evidently a transient" (Dr. M. Gibbs).

233-546-(234). Ammodramus savannarum passerinus (*Wils.*). GRASSHOPPER SPARROW; YELLOW-WINGED SPARROW; CRICKET SPARROW.

Summer resident; "southern part of the state" (Prof. J. A. Allen); "breeds" (Gibbs' Birds of Michigan); "rare and breeds at Port Sanilac" (W. A. Oldfield); "Hillsdale and Lenawee Counties" (A. H. Boies); "increasingly abundant at Plymouth" (J. B. Purdy); Jerome Trombley has found it breeding in a meadow in Monroe Co.; "is becoming very common as the forests are cleared off" (Dr. M. Gibbs); "I have seen them at Ishpeming and Sault Ste. Marie late in May, and have found them common in Wayne and Kent Counties" (E. W. Durfee); two of its common names come from its stridulating note.

234-547-(236). Ammodramus henslowii (*Aud.*). HENSLOW'S SPARROW; HENSLOW'S BUNTING.

Rare; Northwestern Indiana, Lake Co (Butler's Birds of Indiana); included in the list of Michigan birds by both Boies and Covert. Mr. A. W. Butler thinks that this and also Leconte's Sparrow, *Ammodramus leconteii*, will both be found to belong to our Michigan fauna.

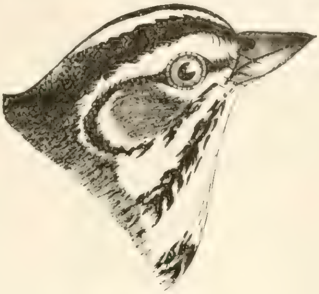
235 549a (241). Ammodramus caudacutus nelsoni *Allen.* NELSON'S SPARROW; NELSON'S SHARP-TAILED FINCH.

Rare; two specimens reported taken October 5, 1878, in Gibbs' Michigan Birds; reported from Northwestern Indian, where perhaps it is a summer resident (Butler's Birds of Indiana).

Genus CHONDESTES Swain.

236-552 (281). Chondestes grammacus (*Say*). Lark Sparrow; Lark Finch.

Not rare in northern part of the state; summer months; "rare and irregular at Ann Arbor" (Dr. J. B. Steere); "Sault Ste. Marie" (A. H. Boies); "rare in Monroe Co., where two nests have been found" (Jerome Trombley); May to August; arrives in flocks; "breeds irregularly and often very locally" (Dr. W. C. Brownell); "not a rare breeder in Wayne Co." (E. W. Durfee); "breeds in the Northern Peninsula" (Prof. Ludwig Kumlein); nests in June on the ground or in bushes; eggs four to six, white with irregular lines of black or brown; "locally common, breeds" (Gibbs). Dr. Atkins makes no mention of this bird but we have taken it here.

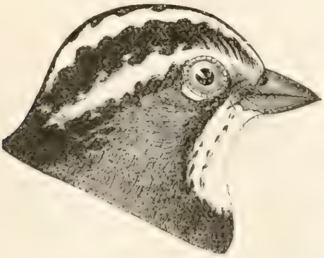


Lark Sparrow, natural size.

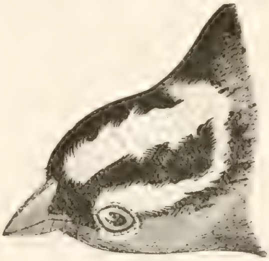
Genus ZONOTRICHIA Swain.

237-554-(276). Zonotrichia leucophrys (*Forst.*). White-crowned Sparrow; White-browed Sparrow; White-browed Crowned Sparrow.

Common; probably a migrant; throughout the entire state, May and October; "common spring and fall at Port Sanilac" (W. A. Oldfield); "Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "breeds in the Northern Peninsula" (Ludwig Kumlein); "doubtful if it breeds in Northern Peninsula" (Dr. A. K. Fisher); "this beautiful singer is a rare migrant at Albion and a common migrant at Palmer, Marquette Co." (O. B. Warren); migrant in Lower Peninsula; "less common in Monroe Co. than the White-throated Sparrow" (Jerome Trombley); solitary; "generally gregarious during migration" (Dr. M. Gibbs); "abundant spring and fall, migrant at Bay City, average date of arrival May 15, many killed the night of May 14, 1890, by electric light tower" (N. A. Eddy).



White-throated Sparrow.



White-crowned Sparrow.

238-558-(275). Zonotrichia albicollis (*Gmel.*). *WHITE-THROATED SPARROW.

Abundant; throughout the entire state; September, April and May; migrant; not uncommon migrant at this place; "though a migrant at Ann Arbor, nests abundantly at Petoskey as late as July" (Dr. J. B. Steere); "common in Grand Traverse Co." (M. L. Leach); "common at Iron Mountain" (E. E. Brewster); "very abundant on Keweenaw Point" (Kneeland); "breeds freely in Northern Peninsula" (Prof. Ludwig Kumlein); "exceedingly abundant at Palmer and throughout all of Marquette Co. where it breeds abundantly, and where its song is heard everywhere; also a common migrant at St. Joseph" (O. B. Warren); "summer resident as far south as Grand Rapids" (Dr. M. Gibbs); S. E. White reports this as breeding abundantly at Mackinac Island; eggs four to five; beautiful singers; usually seen in flocks; N. A. Eddy reports this less abundant than the preceding at Bay City where it precedes the other in both spring and fall migrations.

GENUS SPIZELLA BONAP.

239-559-(268 part). Spizella monticola (*Gmel.*). *TREE SPARROW.

Very common throughout the entire state; "often in flocks with the Junco Snow Birds; "common at Iron Mountain" (E. E. Brewster); "common in winter and early spring at St. Joseph and very common at Palmer, Marquette Co." (O. B. Warren); "Keweenaw Point" (Kneeland); winter resident; October to April; flocks.

240-560 (269). Spizella socialis (*Wils.*). *CHIPPING SPARROW; CHIPPIE; HAIR BIRD.

Very common; throughout the state; April to October; "dates of arrival at Bay City for nine years, between April 3 and April 22" (N. A. Eddy); "Mackinac Island" (S. E. White); "common at Iron Mountain" (E. E. Brewster); "not seen in the Northern Peninsula" (A. H. Boies); "Keweenaw Point" (Kneeland); "very common summer resident at Albion, St. Joseph and Palmer" (O. B. Warren); breeds abundantly; nests in May and June (Robt. H. Wolcott writes me that he took nest with eggs at New Baltimore as late as August 4, 1893) in orchard trees, evergreens, thorn bushes, etc., occasionally in buildings, "one in a straw stack" (N. A. Eddy), "sometimes on the ground" (Dr. J. B. Steere); eggs three to five, bluish green with specks of black and obscure brown; migrate south in flocks; one of our best known and most friendly Sparrows.

241-561-(272). Spizella pallida (*Swain.*). CLAY-COLORED SPARROW.

"Rare in Western Indiana and Northern and Western Illinois, probably visits Michigan" (A. W. Butler); "breeds in Upper Peninsula" (Prof. Ludwig Kumlein); "doubtful if it breeds in Northern Peninsula" (Dr. A. K. Fisher); "a very rare migrant" (A. B. Covert's Birds of Washtenaw Co., Michigan).

242-563-(271). Spizella pusilla (*Wils.*). *FIELD SPARROW.

Exceedingly abundant; throughout the entire state; "not abundant at Ann Arbor" (Dr. J. B. Steere); "rare in Wayne Co." (B. H. Swales); "I don't consider them rare in Wayne Co." (E. W. Durfee); "common at Palmer, and very common at Albion and St. Joseph where it nests frequently in the cultivated raspberry bushes" (O. B. Warren); "abundant in Monroe Co." (Jerome Trombley); "rare at Bay City" (N. A. Eddy); from April to October; "Mackinac Island" (S. E.

White); nests in May; Mr. Robt. H. Wolcott writes me that he took eggs at New Baltimore July 23, 1893; in bushes or on the ground; eggs three to five, grayish white, specked with brown; more shy than the Chipping Sparrow. This delightful singer is a favorite with all lovers of nature.

GENUS JUNCO WAG.

243-567-(261 part). Junco hyemalis (*Linn.*). *SLATE-COLORED JUNCO; COMMON SNOW BIRD; JUNCO; BLACK SNOW BIRD.

Very common; flocks; winter; more common in Spring; not rare in summer, north; "summer resident in Montcalm Co., but a migrant at Ann Arbor" (Dr. J. B. Steere); "Monroe Co. from early spring to May" (Jerome Trombley); "common summer resident at Mackinac" (S. E. White); "common at Iron Mountain" (E. E. Brewster); breeds in the northern part of the state; "breeds in Northern Peninsula" (H. Nehrling); "abundant in late fall and early spring and common in winter at St. Joseph and Albion, and exceedingly abundant at Palmer where it breeds profusely, everywhere you go you will see it in countless numbers" (O. B. Warren); "Keweenaw Point" (Kneeland); "nests at Traverse City, in excavations under logs" (L. W. Watkins); "in bushes two to six feet high" (Gibbs); "on the ground" (Coues); or "hole in stump" (Samuels); eggs four, white with reddish specks; reported by Dr. Atkins at Locke, July 8, 1879, and by C. W. Gunn at Grand Rapids, a pair apparently breeding, July 13, 1878 (Bull. Nutt. Orn. Club, Vol. IV, p. 238); Mr. S. E. White says this bird may breed in Kent Co. as he has taken it in June. These Snow Birds often appear in quite large flocks; N. A. Eddy thinks it a winter resident in the Northern Michigan pine forests.

244-567a-(263). Junco hyemalis oregonus (*Towns.*). *OREGON JUNCO; OREGON SNOW BIRD.

"Accidental visitor" (Dr. M. Gibbs); rare; Dr. Atkins reports taking this bird twice in April. This is quite probably an error. Prof. A. W. Butler thinks these notes may refer to *Junco hyemalis shufeldti*, which has been taken at Lafayette, Indiana.

GENUS MELOSPIZA BAIRD.

245-581-(244). Melospiza fasciata (*Gmel.*). *SONG SPARROW.

Very common; throughout the entire state; from early spring till late fall; occasional in February; "a few remain through the winter in Monroe Co." (Jerome Trombley); "common summer resident at Mackinac Island" (S. E. White); "common at Iron Mountain" (E. E. Brewster); breeds; "Keweenaw Point" (Kneeland); rears two or three broods a season" (Dr. W. C. Brownell); "very abundant at Albion and St. Joseph, where it arrives in late February and March, and at Palmer Marquette Co., where it arrives the first week in April" (O. B. Palmer); nests in April and May (Mr. Robt. H. Wolcott took eggs at New Baltimore July 23, 1893) and August, in bushes, occasionally ten feet high, "have been found in holes of apple trees" (Davie), or on the ground, often surrounded with snow; eggs four or five, sometimes six, and very rarely seven. R. H. Wolcott reports a nest at Ann Arbor, 1892, with seven sparrow eggs and one cow bird's egg, grayish or bluish white, thinly, rarely thickly, dotted with varying shades of brown; beautiful singer;

very desirable bird. This is a great favorite with all lovers of birds. I have seen these birds take the half grown bark lice clean, from the linden twigs, in early spring.

246-583-(242). Melospiza lincolni (*Aud.*). Lincoln's Sparrow.

Very rare; Dr. M. Gibbs reports two specimens taken May, 1875, September 28 and October 9, 1879, and several specimens more recently; E. L. Moseley reports one taken at Grand Rapids in 1887; "should be found breeding in Michigan" (A. W. Butler); "breeds in Northern Peninsula" (Prof. Ludwig Kumlein); N. A. Eddy reports a male killed at Bay City by electric light tower May 15, 1890.

247-584-(243). Melospiza georgiana (*Lath.*). Swamp Sparrow.

Not rare; probably throughout the state; April and August; "common at Ann Arbor, nesting in the open swamps" (Dr. J. B. Steere); "nests freely about swampy lakes at Plymouth" (J. B. Purdy); "occasional at Port Sanilac" (W. A. Oldfield); "Southern Michigan and Upper Peninsula" (A. H. Boies); very common in Kent Co., have taken the eggs and seen thousands of the birds" (S. E. White); Mr. White also reports this species on the mainland north of Mackinac Island; "I have seen a few about Ishpeming" (E. W. Durfee); "tolerably common and breeds at Bay City" (N. A. Eddy); nests on ground usually in swamps; F. M. Falconer reports taking a nest at Hillsdale three feet from the ground; eggs four to five, bluish or grayish white, specked with brown.

Genus PASSERELLA Swain.

Fox Sparrow, natural size.

248-585-(282). Passerella iliaca (*Merr.*). *Fox Sparrow.

Common; throughout the state; migrant; "common migrant at Iron Mountain" (E. E. Brewster); "taken at Ann Arbor" (Dr. J. B. Steere); "an abundant transient" (Dr. M. Gibbs); March and April, and October and November; "Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "rare migrant at Bay City" (N. A. Eddy); a very beautiful singer.

Genus PIPILO Vieill.

249-587-(301). Pipilo erythrophthalmus (*Linn.*). *Towhee; Towhee Bunting; Chewink; Marsh Robin; Ground Robin; Jewee; Joe-wink.

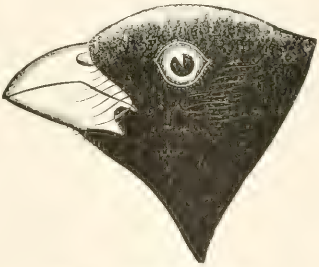
Very common; throughout the state; March to October; reported at Ann Arbor by F. L. Washburn in December (The Auk, Vol. VI, p. 279); Prof. James Satterlee saw it at Greenville the last of November, 1892; "very rare at Mackinac Island" (S. E. White); breeds; "very common at Iron Mountain" (E. E. Brewter); "April to November at Bay City" (N. A. Eddy); nests in bulky but well built nests in June and July, in bushes, low trees, on grass tufts, near the ground, or on the ground. Mr. Robt. H. Wolcott found a nest at Grand Rapids July 26, 1892, in a broken thorn apple tree eight feet from the ground; Dr. Atkins once found a nest on a beech knot, one foot from the ground; eggs three to five, very variable, usually grayish or pinkish white, specked with reddish brown.

GENUS CARDINALIS BONAP.

250 593 (299). Cardinalis cardinalis (*Linn.*). *CARDINAL; CARDINAL GROSBEAK; VIRGINIA RED BIRD.

Very rare; "never seen at Ann Arbor" (Dr. J. B. Steere); "have taken a few specimens in Hillsdale and Lenawee Counties" (A. H. Boies); "a gentleman in Port Sanilac has a live male taken in town when quite young" (W. A. Oldfield); "a few are seen in Monroe Co. every spring" (Jerome Trombley); "a pair taken in Kent Co." (S. E. White); set of eggs taken at Detroit, June 19, 1892 (W. A. Davidson in O. and O., Vol. XVII, 1892, p. 111); Dudley E. Waters took a female in Kent Co. August 10, 1883, and a male October 24, of the same year. He thinks he saw a young bird. Mr. Jerome Trombley writes me that a pair have nested in Monroe for two years past.

GENUS HABIA REICH.



Rose-breasted Grosbeak.

251 595-(289). Habia ludoviciana (*Linn.*). *ROSE-BREASTED GROSBEAK; ROSE-BREASTED SONG GROSBEAK.

Common; throughout the Southern Peninsula at least; May to Sept.; "Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "said to be common in hard wood districts about Iron Mountain, but I have not taken it" (E. E. Brewster); "common at St. Joseph and Albion, where its song can be heard in the city every day of May and June, and common at Palmer, twenty miles from Marquette, where it breeds" (O. B. Warren); L. W. Watkins informs me that this bird nests at Manchester in low bushes, and also breeds at Traverse City; beautiful singer; often seen in flocks; breeds; Mr. L. W. Watkins informs me that he took a male from a nest of five eggs, on which he was sitting; nests in May and June, in orchards, tall shrubs, forest trees, etc., occasionally high up. E. B. Boies reports a nest in a thorn bush, April 19, 1891. Eggs three to five, bluish green, dotted with brown; "male often incubates" (R. H. Wolcott); very beneficial to the farmer and horticulturist, even eats potato beetles as I have observed on several occasions; Forbes says (report State Horticultural Society, 1881, p. 204) that 66 per cent of food of many examined, consisted of canker worms; the sóng of this bird is delightful.

Genus PASSERINA Vieill.

252-598 (295). **Passerina cyanea** (*Linn.*). *Indigo Bunting; Indigo Painted Finch; Indigo Bird; Blue Linnet.

Common; throughout the state; May to October; "Mackinac Island" (S. E. White); "common at St. Joseph, Albion and Palmer" (O. B. Warren); "common at Iron Mountain" (E. E. Brewster); nests in May and June, in low bushes, often in gardens; eggs four, white with a bluish tinge. Prof. S. A. Forbes (Bulletin No. 3) found 78 per cent of the food of several which he examined to be canker worms.

253-600 (293 part). **Passerina versicolor** (*Bonap.*). *Varied Bunting.

Dr. Atkins reported taking this rare bird; said to have been observed in Michigan by A. H. Boies. "I think I have seen it" (Dr. Robert Ridgway); taken by Dr. Atkins, May 18, 1874, identified by Ridgway, and now in the collection of Dr. J. M. B. Sill, of Ypsilanti (Dr. Atkins in O. and O., Vol. IX, 1884, p. 81).

Genus SPIZA Bonap.

254-604-(287). **Spiza americana** (*Gmel.*). *Dickcissel; Black-throated Bunting; Little Meadow Lark.

Very common in some localities in Southern Michigan; rare at the college; "a recent arrival" (Dr. J. B. Steere); May to August; "occasional at Ann Arbor" (Dr. J. B. Steere); "Hillsdale Co." (A. H. Boies); "common at Port Sanilac" (W. A. Oldfield); breeds; nests usually in bushes, sometimes on the ground; eggs four, immaculate, greenish blue; "very common at Manchester, summer of 1892, and the nests were abundant in clover fields" (L. W. Watkins); food largely insects; some examined by Prof. S. A. Forbes (Michigan Horticultural Report, 1881, p. 204) showed one-half the food to be canker worms; "not known in Michigan twenty years ago, but becoming more common each year, still rarely found north of 44° north latitude" (Dr. M. Gibbs).

Family TANAGRIDÆ. Tanagers.

Highly colored, purely insectivorous.

Genus PIRANGA Vieill.

255-608 (154). **Piranga erythromelas** *Vieill.* *Scarlet Tanager; Black-winged Redbird.

Common throughout Southern Michigan at least; May to August, occasionally to October; "rare at Mackinac Island" (S. E. White); "common at Albion and St. Joseph in orchards, bordering or near oak woods, and seen at Palmer in July and September 11, 1893" (O. B. Warren); "common at Iron Mountain" (E. E. Brewster); "rather common on Keweenaw Point" (E. W. Durfee); breeds; nests in May or June, usually on top of horizontal limb, in orchard or small trees, from twenty to fifty feet from ground on or near ends of swaying branches" (Dr. W. C. Brownell); "often twenty or thirty feet, and rarely as many as forty feet from the ground" (Prof. Ludwig Kumlein); "nest loose, shallow and coarse" (Prof. J. W. Simmons); eggs three to five, greenish blue spotted with brown; not only a sweet singer, but our most showy bird. Mr. George D. Sones writes me that the nests are often so poorly built that the eggs may be counted from below looking up through the nests. This bird, of late, comes close to our houses on the college campus.

256 610-(155). Piranga rubra (*Linn.*). *SUMMER TANAGER; SUMMER REDBIRD.

Exceedingly rare, and only in extreme southern limit; straggler from the south; not so brilliant as the preceding species, and the male has not the black wings. E. L. Moseley reports one from Michigan; "not seen at Ann Arbor" (Dr. J. B. Steere); "never seen in Monroe Co." (Jerome Trombley); if ever seen in Michigan an accidental and very rare straggler.

FAMILY HIRUNDINIDÆ. SWALLOWS.

These feed wholly on insects; are very beneficial, and very amiable toward each other.

GENUS PROGNE BOIE.

257-611-(165). Progne subis (*Linn.*). *PURPLE MARTIN.

Common throughout the summer, or was so, prior to the reign of the English Sparrows; throughout the state; "still common at Port Sanilac" (W. A. Oldfield); "rare in Monroe Co." (Jerome Trombley); "common at Iron Mountain" (E. E. Brewster); "rare outside Detroit, I hunted for four years to find a set of eggs for my collection" (Dr. W. C. Brownell); "common at New Baltimore, where English Sparrows are yet rare" (Robt. H. Wolcott); "very common at St. Joseph and Albion till driven off by English Sparrows, and it is disappearing similarly from Palmer" (O. B. Warren); "common every year at Hubbardston, where it arrives April 7 to 9 each year" (Prof. C. W. Wheeler); "rare and local in Washtenaw Co." (Dr. J. B. Steere); "becomming very rare at Plymouth" (J. B. Purdy); "Grand Traverse Co." (M. L. Leach); "breeds at Mackinac Island" (S. E. White); "nests commonly at Alma, Gratiot Co., in the false fronts of stores, where it successfully combats the European Sparrow" (Prof. C. A. Davis); will oppose the European Sparrow successfully for a time but will finally yield the fort; "nests in Hillsdale in the hoods over electric lights" (F. M. Falconer); breeds; nests in June, in boxes, holes in trees, etc.; eggs four to six, white; food insects, even Wasps and May Beetles; "this bird arrives at Bay City from April 10 to April 30, it is very attached to old nesting place, which nothing can induce it to leave" (N. A. Eddy).

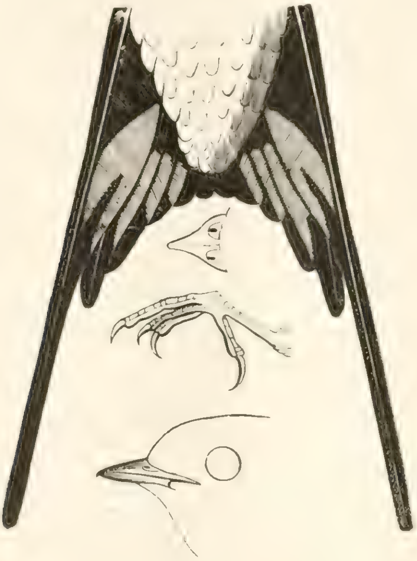
GENUS PETROCHELIDON CAB.

258-612-(162). Petrochelidon lunifrons (*Say.*). *CLIFF SWALLOW; EAVE SWALLOW; MUD DAUBER; SQUARE-TAILED BARN SWALLOW.

Very common; throughout the state; May to August; "rare and local in Washtenaw Co." (Dr. J. B. Steere); "I have counted one hundred and ninety-three nests under the eaves of one barn, from which I think over two thousand young were hatched in one season" (Dr. W. C. Brownell); "very common at St. Joseph and Albion" (O. B. Warren); "occurs at Chandler's Falls, on the Escanaba River, Upper

Peninsula, where it breeds" (L. W. Watkins); "Mackinac Island" (S. E. White); breeds; nests under eaves, on sides of embankments, rocks, etc., preferring the south, east or west side; nests of mud; eggs four to six, white, specked with quite large brown spots. Like other birds that nest around our farm buildings, they are being driven off by the English Sparrow. L. W. Watkins reports an entire brood of albinos.

Genus CHELIDON Forster.



Generic details of Barn Swallow.

259-613-(159). Chelidon erythrogaster (*Bodd.*). *Barn Swallow.

Very abundant throughout the state; April to August; "breeds abundantly and like the preceding seen in immense flocks at Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "most abundant Swallow at Bay City" (N. A. Eddy); breeds; nests in May, in barns and other buildings; "I saw about 300 at my farm at Plymouth, September 4, 1886, and not one after that date" (Dr. W. C. Brownell); two broods and sometimes three; nest and eggs were taken by Mr. Robt. H. Wolcott at New Baltimore, July 23, 1893; eggs three to six, white, finely spotted with brown, especially at the large end; the tail of this bird is deeply forked. This graceful bird is justly a favorite with farmers and farmers' boys. They are often seen in large flocks just before leaving in early September.

Genus TACHYCINETA Cab.

260-614-(160). Tachycineta bicolor (*Vieill.*). *Tree Swallow; White-bellied Swallow; Blue-backed Swallow; Field Swallow.

Very common; throughout the state; March or April to August; "very common at St. Joseph, Albion and Palmer" (O. B. Warren); "common at Iron

Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); breeds; often two broods; nests in May and June, in hollow stumps or holes in trees or buildings, "often in stubs in or near water" (Dr. W. C. Brownell); eggs four to seven, occasionally nine, white. I have taken several nests from hollow stumps, and always found them lined with pure white feathers, many of which were too large to have come from this bird. "Arrives at Bay City from April 4 to April 16" (N. A. Eddy).

White-bellied Swallow, natural size.

GENUS CLIVICOLA FORST.

261–616–(163). Clivicola riparia (*Linn.*). *BANK SWALLOW; SAND SWALLOW; SAND MARTIN.

Very abundant; throughout the state; May to August; "rather common at Albion and exceedingly abundant at St. Joseph where flocks of thousands are often seen in August" (O. B. Warren); "breeds extensively at Mackinac Island" (S. E. White); breeds abundantly; nests in May in sand banks; "very common at Port Sanilac where it breeds in colonies along the lake shore" (W. A. Oldfield); "no suitable breeding places at Bay City" (N. A. Eddy); eggs five or six, white; these birds are very amiable, never seen quarreling; "I have found three nests in branches of one hole" (Dr. W. Brownell); Mr. Robt. H. Wolcott saw at White Lake, Muskegon Co., July, 1891, an immense colony, numbering hundreds. The bank was very sandy and several nests had a common vestibule near the face of the bank.

GENUS STELGIDOPTERYX BAIRD.

262–617–(164). Stelgidopteryx serripennis (*Aud.*). *ROUGH-WINGED SWALLOW.

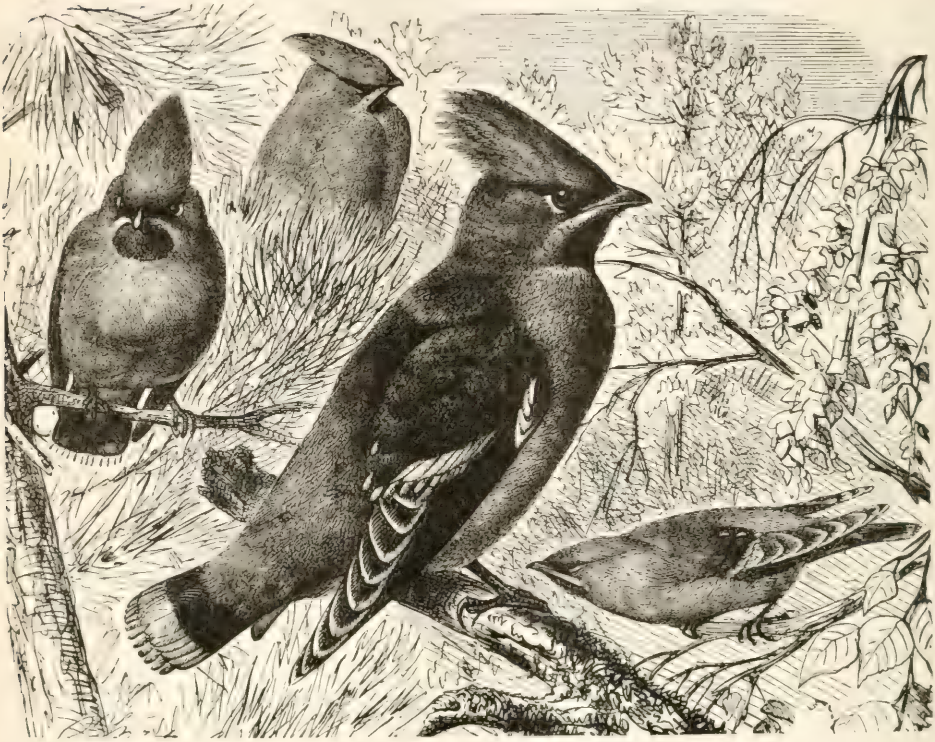
Rather common; "in the southern part of the state" (Prof. J. A. Allen); Mr. S. E. White reports finding a dead specimen at Mackinac Island in July, 1890; May to August; nests in May, in sand banks, or "buildings or crevices in stone walls" (A. W. Butler); eggs and food habits much as in bank swallows. Dr. Gibbs informs me that the opening to the nest is circular, and not eliptical as it always is in the case of the Bank Swallow. He adds further that this bird often builds in crevices in bridges, etc.

Family AMPELIDÆ. Waxwings.

Beautiful birds; fly in flocks; feed on seeds, insects and fruit.

Subfamily AMPELINÆ. Waxwings.

Genus AMPELIS Linn.



Bohemian Waxwing, one-half natural size.

263-618-(166). Ampelis garrulus *Linn.* *Bohemian Waxwing.

Very rare; winter visitor; occasional in spring; Dr. G. W. Topping, DeWitt, Michigan, took from one to three in April of each of the years 1879-80-81 from flocks going north; "in flocks in Kent Co. nearly every spring, often as many as one hundred" (Dudley E. Waters); Does not Mr. Waters refer to the next species? "occasional at Port Sanilac in winter" (W. A. Oldfield); Mr. Levi Broas has several in his collection, which he took in Ionia Co.; "seen in early spring at Bay City in 1884, may possibly be mistaken in identification" (N. A. Eddy, in O. and O., Vol. IX, 1884, p. 41); "saw a flock of about a dozen on Keweenaw Point in January, 1892, they were very fearless, keeping on with their feeding when I was within five feet of them" (E. W. Durfee); Dr. Atkins took this bird at Locke several times in March and once in April; E. L. Moseley reports two from Michigan; "four seen in Kent Co., April 4. 1889" (S. E. White); "often exceedingly abundant in Northern Michigan" (H. Nehrling); "several flocks seen at Charlevoix in the fall; several years since" (M. L. Leach); "Upper Peninsula" (A. H. Boies); "Keweenaw Point" (Kneeland); "Traverse City" (M. L. Leach); "has been taken in Southern Indiana several times" (A. W. Butler).

Cedar Bird, natural size.

264–619–(167). Ampelis cedrorum (*Vieill.*). *Cedar Bird; Cedar Waxwing; Cherry Bird.

Very common; throughout the state; April to August; not rare in winter; embraced in Cabot's Birds of Lake Superior; "common summer resident at Mackinac Island" (S. E. White); "common at Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); "abundant at Albion and St. Joseph and very common along Escanaba River, where it feeds extensively on insects" (O. B. Warren); migrates frequently for short distances; in flocks; breeds; nests in bushes, trees of the orchard or woodland, etc., in July and August; eggs four to six, light drab or clay white, specked with black and brown; eats cherries, apple blossoms, berries and insects, "eats one hundred canker worms daily" (Forbes' Report Michigan State Horticultural Society, 1881, p. 204); "I have been them feeding extensively on canker worms" (Prof. C. A. Davis); "eat elm beetles and many other insects" (Dr. A. K. Fisher). From a preliminary report by F. E. L. Beal for the United States Department of Agriculture, manuscript kindly loaned to me, I find that 125 stomachs of these birds from fourteen states were examined. The conclusions reached were these: 1st, that the Cedar Birds eat a certain amount of insect food at all times, when it can be obtained, aggregating in this case seventeen per cent of the food for the whole year; 2d, that the greatest amount of insect food is eaten during the month when fruit is the most abundant; 3d, that the greatest number of insects is eaten in the month of May, with a decrease during the succeeding months until September, when the percentage again rises; 4th, that the young, while in the nest, are fed to a great extent on insect food; eats mountain-ash berries, etc., in winter. These beautiful birds are by no means exclusively insectivorous, and a flock will destroy an immense number of cherries; Dr. Gibbs writes me that he has reared the young taken from the nests, entirely on fruit; "very erratic at Bay City, abundant some years, then entirely absent for a time" (N. A. Eddy).

Family LANIIDÆ. Shrikes.

Feed on insects, small birds, mice, etc.; on the whole probably our friends.

Genus LANIUS Linn.

Butcher Bird, reduced.

265 621 (186). Lanius borealis *Vieill.* *Northern Shrike; Butcher Bird.

Rather common; throughout the state; "rare at Ann Arbor" (Dr. J. B. Steere); "common at St. Joseph and Albion in winter where it kills English Sparrows, and seen at Palmer from September to April" (O. B. Warren); winter; November to March or April; "occasionally in winter in Wayne Co." (B. H. Swales); "quite common in winter at Port Sanilac" (W. A. Oldfield); seen at Iron Mountain by E. E. Brewster; "Keweenaw Point" (Kneeland); "this shrike is not known to breed in United States" (Dr. A. K. Fisher); Prof. J. A. Allen thinks it may breed in Upper Peninsula; impales mice, insects, small birds, frogs, etc., on thorns, probably for future use; "kills English Sparrows, and impales insects on barbs of wire in fences" (Dr. W. C. Brownell); Prof. Chas. A. Davis tells me that an observant friend suggests that this habit has arisen because the bird has no talons, so it hangs bird, mouse, or insect up to aid in tearing it to pieces; "all winter at Manchester, chasing and killing English Sparrows" (L. W. Watkins); these birds are reported to attract other birds by mimicry and then destroy them; Dr. G. W. Topping, Dr. W. C. Brownell, and Mr. J. B. Purdy speak of the nesting of this bird. They must refer to the White-rumped Shrike.

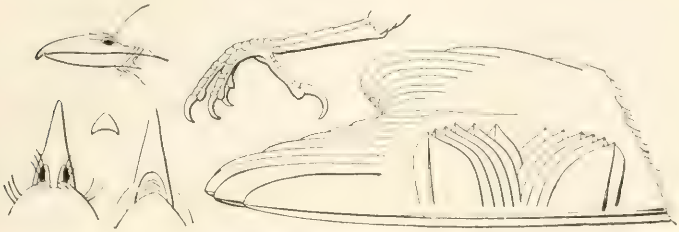
266 622a (188 part). Lanius ludovicianus excubitorides (*Swains.*). *White-rumped Shrike.

Common from April to October; "the common variety in Monroe Co." (Jerome Trombley); breeds; nests in April and May in orchards; "common summer resident at Albion and St. Joseph" (O. B. Warren); "tolerably common at Bay City" (N. A. Eddy); "nests rarely at Ann Arbor" (Dr. J. B. Steere); eggs four to seven, dirty white specked with brown. These birds do destroy small birds, but as they destroy so many insects, especially locusts, they are to be considered as beneficial to the farmer. This species is often mistaken for the Loggerhead Shrike, *Lanius ludovicianus*, which does not occur in Michigan.

FAMILY VIREONIDÆ VIREOS OR GREENLETS.

Beautiful singers; exclusively insectivorous; very beneficial.

GENUS VIREO VIEILL.



Red-eyed Vireo, natural size.

267-624-(170). Vireo olivaceus (*Linn.*). *RED-EYED VIREO: RED-EYED GREENLET.

One of our most common birds; throughout the state; frequents parks and woodlands; April to September; included in Cabot's list of Birds of Lake Superior; "abundant summer resident at Mackinac Island" (S. E. White); E. E. Brewster finds this species very common at Iron Mountain; "Keweenaw Point" (Kneeland); breeds; often double brooded; nests in June on the horizontal branches of trees—the nests are often suspended from horizontal branches—usually in woodlands, occasionally in orchards; the nest is very beautiful; "this beautiful singer is common at Palmer, Marquette Co., and abundant in orchards at Albion and St. Joseph" (O. B. Warren); "nests in Traverse City" (L. W. Watkins); nest suspended below limb, not hanging like those of Orioles; eggs three to four, rarely five, white, spotted with blackish dots.

Brotherly Love Vireo, natural size.

268-626-(173). Vireo philadelphicus (*Cass.*). *PHILADELPHIA VIREO; BROTHERLY-LOVE VIREO; BROTHERLY-LOVE GREENLET.

Rare; migrant; taken at the college September 11, 1889; "rare in Kalamazoo Co." (Dr. M. Gibbs); Dr. M. Gibbs writes me that he has taken it in Kalamazoo and Ottawa Counties; "quite common fall migrant at Mackinac Island, where it eats raspberries; have taken several in Kent Co." (S. E. White); we find it not uncommon here this May, 1893; Forbes found (Report Michigan State Horticultural Society, 1881, p. 204) that 35 per cent of food consisted of canker worms.

269-627 (174, 175). Vireo gilvus (*Vieill.*). *Warbling Vireo; Warbling Greenlet.

Common throughout the state; April to September; "common at Ann Arbor" (Dr. J. B. Steere); "common and breeds at Port Sanilac" (W. A. Oldfield); "common at Plymouth" (J. B. Purdy); "Hillsdale and Lenawee Counties and Upper Peninsula" (A. H. Boies); "common at Albion" (O. B. Warren); "one killed by electric light tower at Bay City, May 15. 1890" (N. A. Eddy); "rare summer resident Mackinac Island" (S. E. White); breeds; has been known to steal material for nest building from King Birds' nests at Plymouth. Michigan (see O. and O., Vol. XIV, p. 93); nests and eggs as in *Vireo olivaceus*. except nests are usually in orchards between twigs and not pendulous from a fork, are thicker and firmer. slightly smaller, with softer lining. and the eggs less specked; "one of the very few birds that sings as it sits on its nest" (Dr. M. Gibbs); Forbes found (Report of Michigan Horticultural Society, 1881, p. 204) that thirty-five per cent of food was canker worms; nests abundantly at Manchester, the nest hanging from the horizontal crotch of a limb" (D. Whitney Watkins). This sweet singer is a very valuable bird.

Warbling Greenlet.

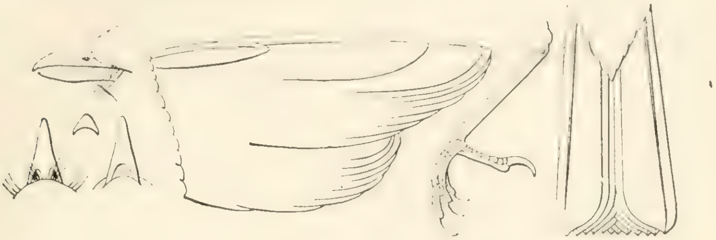
Yellow-throated Vireo, natural size.

270-628-(176). Vireo flavifrons (*Vieill.*). *Yellow-throated Vireo.

Common; April to September; "common at Ann Arbor" (Dr. J. W. Steere); "rare in Wayne Co." (B. H. Swales); "common in some parts of Wayne Co.. where I once took a set of eggs, when the bird allowed me to catch her and after I let her go she came back so I could touch her, she showed no fear" (E. W. Durfee); "common in Hillsdale and Lenawee Counties" (A. H. Boies); "common and breeds at Port Sanilac" (W. A. Oldfield); "killed by electric light tower at Bay City. May 15. 1890" (N. A. Eddy); "Mackinac Island" (S. E. White); breeds; nests in June, in trees; "nest from seven to thirty feet high. usually about twelve. and covered with lichens" (Dr. M. Gibbs); eggs rosy white, spotted with brown.

271 629 (177). Vireo solitarius (*Wils.*). *Blue-headed Vireo or Greenlet; Solitary Greenlet.

Rare; May and October; migrant; S. E. White finds this at Mackinac Island; E. E. Brewster has taken it at Iron Mountain; Dr. M. Gibbs writes me that it is a summer resident in Wexford Co.



White-eyed Vireo, natural size.

272 631-(181). Vireo noveboracensis (*Gmel.*). *White-eyed Vireo or Greenlet.

"Scarce summer sojourner, breeds" (Dr. M. Gibbs on authority of Messrs. A. B. Covert and the late D. D. Hughes); "have taken two specimens at Port Sanilac" (W. A. Oldfield); "Keweenaw Point" (Kneeland); embraced in Cabot's Birds of Lake Superior.

Family MNIOTILTIDÆ. Warblers, Woodland Warblers.

Small birds; often sweet singers; usually beautiful; mostly insectivorous; eggs almost always bluish white or cream colored, specked with brown. Of many killed this spring—1893- the stomachs almost invariably contained both seeds and insects.

Genus MNIOTILTA Vieill.

Black and White Creeper, natural size.

273 636-(91, 92). Mniotilta varia (*Linn.*). Black and White Warbler; Black and White Creeper.

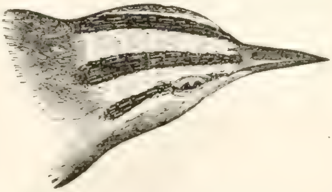
Throughout the Lower Peninsula at least; common; rare in some localities; a pair taken at college by A. B. Cook, May 10, 1893; "rare summer resident but common migrant at Mackinac Island" (S. E. White); breeds; "not observed nesting at Ann Arbor" (Dr. J. B. Steere); "not common but breeds in Monroe Co. and always on the ground" (Jerome Trombley); "common spring migrant at Albion and seen at Palmer from May to August" (O. B. Warren); "Dennis Nolan found a nest under a log in Kalamazoo Co." (Dr. M. Gibbs); "never found a nest at Plymouth" (J. B. Purdy); "found one nest in Wayne Co." (Dr. W. C. Brownell); "not uncommon on Keweenaw Point where they breed" (E. W. Durfee); nests in May, usually on the ground, under logs, very rarely in hollow trees; eggs four or five, white with yellowish tinge, and specked with brown, most of the brown is in the form of a wreath around the large end; eats insects and insects' eggs; very beneficial. This bird reminds us of the Creepers and Titmice, in its climbing along branches in quest of insects.

Genus PROTONOTARIA Baird.

274-637-(95). Protonotaria citrea (*Bodd.*). *Prothonotary Warbler; Golden Swamp Warbler; Willow Warbler.

Rare at Lansing; "abundant the last few years in Southwestern Michigan" (Dr. M. Gibbs); "rare along Kalamazoo river in Allegan Co." (S. E. White); "Lenawee Co." (A. H. Boies); "has not been observed in Monroe Co." (Jerome Trombley); breeds; found breeding in Michigan, latitude 42° north, by K. R. Willhelm; nests in June, in holes in trees, stumps, etc.; "always nests near water, usually over it" (Dr. M. Gibbs); "at St. Joseph" (Butler's Birds of Indiana); "not rare in Cass Co., found in swamps and thickets" (Prof. J. W. Simmons). For interesting account of its migration routes, see "Notes on the range of the Prothonotary Warbler in Indiana," by Amos W. Butler, O. and O., March, 1888, pp. 33-34; also "Proceedings Indiana Academy of Science," 1891, p. 165.

Genus HELMITHERUS Rafin.



Worm-eating Warbler, natural size.

275-639 (96). Helmitherus vermivorus (*Gmel.*). Worm-eating Warbler.

Rare; "Lenawee and Hillsdale Counties" (A. H. Boies); "Northern Indiana, song very like that of Chipping Sparrow" (A. W. Butler).

Genus HELMINTHOPHILA Ridg.

276-641 (98). Helminthophila pinus (*Linn.*). Blue-winged Warbler; Blue-winged Yellow Warbler.

Rare; "summer sojourner" (Gibbs' Birds of Michigan); "very rare in Monroe Co. where it is transient, only two ever seen" (Jerome Trombley); "locally distributed" (Dr. M. Gibbs); breeds; nests in May on the ground; eggs four to five; "this and the preceding species are very rare in Northern Indiana" (A. W. Butler); S. E. White saw one of these on Mackinac Island July 1, 1889. *Helminthophila leucobronchialis* (*Brewst.*), which has been reported from Michigan. (The Auk, Vol. I, pp. 359–363), is now regarded as a hybrid between this and the next species, as I learn from Prof. J. A. Allen. The same is doubtless true of the bird described as *Helminthophila gunnii* in the Grand Rapids Daily Democrat, June 1, 1879.

277 642-(102). Helminthophila chrysoptera (*Linn.*). *GOLDEN-WINGED WARBLER; BLUE GOLDEN-WINGED WARBLER.

Throughout the state; May to August; "common summer resident in Monroe Co." (Jerome Trombley); "Mackinac Island" (S. E. White); "have found nests with four eggs at Plymouth" (J. B. Purdy); breeds; nests in May, on the ground; eggs four to five, rarely six; one of our most beautiful warblers. Dr. M. Gibbs writes me that he has taken many nests in Kalamazoo Co.; "common summer resident at Albion" (O. B. Warren); Mr. Davie says that Mr. J. P. Norris has a set of four eggs from Monroe Co., Michigan, and a set of five from near Detroit (Nests and Eggs of North American Birds, p. 360).

278-645-(106 part). Helminthophila ruficapilla (*Wils.*). *NASHVILLE WARBLER.

Rather common; migrant; May; "very common migrant in Lake Co., Indiana, and also a rare resident" (Dr. Brayton's Birds of Indiana, p. 105); "not very common at Port Sanilac, but I took one nest in 1892 with four eggs" (W. A. Oldfield); "often common in Monroe Co." (Jerome Trombley); "two picked up at Bay City under electric light tower" (N. A. Eddy); "rather common migrant in Wayne Co." (E. W. Durfee); "Mackinac Island where it breeds" (S. E. White); "breeds at Palmer" (O. B. Warren); "common at Iron Mountain" (E. E. Brewster); probably breeds in the Northern Peninsula; nests in June, on the ground; eggs three to five; feeds on insects; beneficial.

279 646 (107). Helminthophila celata (*Say*). *ORANGE-CROWNED WARBLER.

Rare; May and September; migrant; this one is easily mistaken for the last mentioned species; "Plymouth" (J. B. Purdy); "one killed at Bay City in spring by electric light tower" (N. A. Eddy); "common but migrant at Ann Arbor" (Dr. A. K. Fisher); reported several times by Dr. Atkins at Locke.

280 647-(109). Helminthophila peregrina (*Wils.*). *TENNESSEE WARBLER.

Not common; "rare in Monroe Co." (Jerome Trombley); "one taken under electric light tower at Bay City, October 2, 1889. Hundreds of Warblers were killed during the night, seven different species were brought to me. The night was clear, the moon bright, and there was little wind" (N. A. Eddy); taken at Plymouth by J. B. Purdy; May and September and October; "have taken a few on Keweenaw Point, July 12, 1893" (E. W. Durfee); migrant; "breeds near L'Anse, Upper Peninsula" (Prof. Ludwig Kumlein); often mistaken for the Nashville Warbler. S. E. White finds this common in late September, and late October at Mackinac Island, where it is also a migrant.

Genus COMPSOTHLYPIS Cab.

281-648 (93). Compsothlypis americana (*Linn.*). *Parula Warbler; Blue Yellow-backed Warbler.

Rare; May and June; "Lenawee and Hillsdale Counties" (A. H. Boies); "abundant migrant at Mackinac Island" (S. E. White); occasionally breeds; nests in June, in trees; "often in a bunch of lichens" (Dr. A. K. Fisher); nest elaborate; eggs four to five, white with yellowish tinge and specked with brown. "Never found a nest at Plymouth" (J. B. Purdy); "this bird is a transient in Monroe Co., where it is becoming very rare" (Jerome Trombley).

Genus DENDROICA Gray.

282-650-(126). Dendroica tigrina (*Gmel.*). Cape May Warbler.

Not rare in spring and autumn; "common in Kent Co. in spring migrations, not rare in autumn; migrant; frequents the orchards and pines and not an uncommon migrant on Mackinac Island" (S. E. White); "Palmer, Marquette Co." (O. B. Warren); "see them every year in Kent Co. from May 7 to May 15, have killed fifteen in one day" (Dudley E. Waters); "killed by electric light tower at Bay City, May 15, 1890" (N. A. Eddy); I have it reported from Thunder Bay Island; "Lenawee Co." (A. H. Boies); "Monroe Co., very rare, only two seen" (Jerome Trombley); "Mackinac Island" (S. E. White); seen by E. W. Durfee at Ishpeming May, 1893; in Cabot's list of Birds of Lake Superior; "known to breed near Green Bay Wisconsin" (Prof. Ludwig Kumlein).

283 652 (111 part). Dendroica æstiva (*Gmel.*). *Yellow Warbler; Yellow Bird; Summer Yellow Bird.

Our most common resident warbler; April and May to August and September; taken at college by A. B. Cook, May 10, 1893, who finds it common; "arrives at Bay City, where it breeds in abundance, from May 4 to May 13" (N. A. Eddy); "not observed in Upper Peninsula" (A. H. Boies); "abundant summer resident at Mackinac Island" (S. E. White); "taken at Iron Mountain" (E. E. Brewster); "Keweenaw Point" (Kneeland); "very abundant at Albion and St. Joseph, and seen at Palmer" (O. B. Warren); breeds; nests in May, in thick foliage, in bushes or small trees, especially in willows along streams; nests exquisite; eggs four, occasionally five, yellowish white or greenish gray, specked with brown; J. B. Purdy reports a full set of albino eggs; Forbes found (see Report of Michigan Horticultural Society, 1881, p. 204) that sixty-six per cent of the food of several birds examined consisted of canker worms. "It feeds extensively on the larvæ of elm beetles" (Dr. A. K. Fisher). This is an excellent little bird friend.

284-654-(117). Dendroica cærulescens (*Gmel.*). *Black-throated Blue Warbler.

Common; migrant; two pairs taken at college by A. B. Cook, May 10, 1893; "common migrant and often a summer resident at Mackinac Island" (S. E. White); "many killed at Bay City by electric light tower, October 1, 1889; taken at Heisterman's Island in fall" (N. A. Eddy); possibly breeds north; "C. W. Gunn found it breeding in Ottawa Co." (Dr. M. Gibbs); "migrant in Southern Michigan" (Jerome Trombley);

"common migrant in Wayne Co., and breeds freely on Keweenaw Point" (E. W. Durfee) "taken at Iron Mountain in spring" (E. E. Brewster); nests in low brushwood; eggs four to five, rosy white, and, like those of most warblers, specked with brown.

Yellow-rumped Warbler, natural size.

285-655-(119). Dendroica coronata (*Linn.*). *Myrtle Warbler; Yellow-rumped Warbler; Golden-crown Warbler.

Very common; throughout the entire state; several taken in May, 1893, at college, by A. B. Cook; migrant in the southern part of the state; "very common spring migrant at Albion, and seen at Palmer, Marquette Co." (O. B. Warren); "earliest spring dates at Bay City, April 14, latest, May 15; common fall migrant at Heisterman's Island" (N. A. Eddy); "breeds at Port Sanilac" (W. A. Oldfield); one nest found near Detroit by B. H. Swales (O. and O., Vol. XVI, 1891, p. 148); April or May and October; "our earliest migrant at Morrice" (Dr. W. C. Brownell); "our earliest warbler at Iron Mountain, taken April 16, 1890" (E. E .Brewster); breeds north; "nests at Mackinac Island in July and August" (S. E. White); "Keweenaw Point" (Kneeland); "nests in evergreens, eggs four" (J. W. Simmons).

Black and Yellow Warbler, natural size.

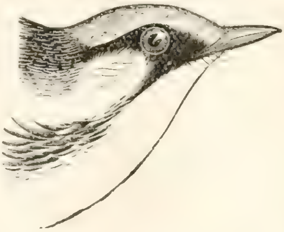
286-657-(125). Dendroica maculosa (*Gmel.*). *Magnolia Warbler; Black and Yellow Warbler.

Common; migrant; "quite common migrant in Monroe Co." (Jerome Trombley); "common but shy in Lenawee Co." (A. H. Boies); "many killed by electric light tower at Bay City, October 2, 1889" (N. A. Eddy); taken by E. E. Brewster at Iron Mountain;" "Keweenaw Point" (Kneeland); "common migrant at Albion, and common summer resident at Palmer, Marquette Co." (O. B. Warren); "common migrant in Wayne Co. and breeds freely on Keweenaw Point, where I have taken two sets of eggs" (E. W. Durfee); May and June, and September and October;

embraced in Cabot's Birds of Lake Superior; "abundant at Mackinac Island where it breeds" (S. E. White); "builds in Northern Michigan" (Davie's Nests and Eggs of North American Birds); a beautiful species.

287–658–(118). Dendroica cærulea (*Wils.*). *CERULEAN WARBLER; BLUE WARBLER.

Rather common; "Lenawee Co." (A. H. Boies); "DeWitt" (Dr. G. W. Topping); "next to Yellow Warbler the most common warbler breeding in Monroe Co." (Jerome Trombley); rare migrant at Bay City" (N. A. Eddy); "have only taken one in Kent Co." (S. E. White); "common spring migrant at St. Joseph, rare at Albion, where it may breed, and seen at Palmer" (O. B. Warren); "common summer resident in Wayne Co., where I have taken sets of three, four and five eggs" (E. W. Durfee); May and June; very handsome; breeds; "several nests taken in Wayne Co." (Dr. W. C. Brownell); nest taken near Detroit, June 19, by W. A. Davidson (O. and O., Vol. XVII, 1892, p. 111); nests in May in high trees; this is quite common in the thickets about the college.



Chestnut-sided Warbler, natural size.

288–659–(124). Dendroica pensylvanica (*Linn.*). *CHESTNUT-SIDED WARBLER.

Very common, some seasons; throughout the entire state; "migrant at Plymouth" (A. B. Purdy); "common spring migrant at Bay City" (N. A. Eddy); "Mackinac Island where it breeds" (S. E. White); "very common migrant at Albion, and very common summer resident at Palmer, Marquette Co." (O. B. Warren); "very common resident at Iron Mountain" (E. E. Brewster); "more commonly found in swamps" (Prof. J. W. Simmons); several taken at college—the first May 10—by A. B. Cook in May, 1893. He finds it the most common Warbler; breeds; "breeds commonly in Wayne Co., and I have seen a few on Keweenaw Point" (E. W. Durfee); "breeds at Port Sanilac" (W. A. Oldfield); "nests found near Detroit by B. H. Swales" (O. and O., Vol. XVI, 1891, p. 148). Dr. M. Gibbs writes me that he once found five nests in one day in Kalamazoo Co., where it rarely builds now; said to be two brooded in Canada; nests in June, in low bushes; eggs four or five. This species rears many Cow Birds.

289–660–(123). Dendroica castanea (*Wils.*) *BAY-BREASTED WARBLER.

Rather common; migrant in Southern Michigan; May and October; "Lenawee Co. and Northern Peninsula" (A. H. Boies); "taken at Bay City in both fall and spring migrations" (N. A. Eddy); "not uncommon migrant in Wayne Co., but rare on Keweenaw Point" (E. W. Durfee); "breeds in Northern Peninsula" (Prof. Ludwig Kumlein); male taken at college May 20, 1893, by A. B. Cook; "breeds in northern Michigan" (Davies Nests and Eggs of North American Birds, p. 373). S. E. White writes me that he shot immature specimens at Mackinac Island as late as July; we have taken this species here more frequently in the the spring; Dr. Atkins reports this species as very rare at Locke. Its song is very charming.

Black-poll Warbler, natural size.

290-661-(122). Dendroica striata (*Forst.*). *Black-poll Warbler.

Common; migrant; a pair taken by A. B. Cook at the college May 20, 1893; "Monroe Co., some years very common" (Jerome Trombley); "a migrant in great numbers at Heisterman's Island, the last of August and first of September, my only examples from Bay City, furnished by electric light tower" (N. A. Eddy); "rare summer resident, but abundant migrant at Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "Iron Mountain, May 21, 1881" (E. E. Brewster); "not very common migrant in Wayne Co., a pair built a nest there in the summer of 1888, but never used it" (E. W. Durfee); "common spring migrant in Upper Peninsula" (Prof. Ludwig Kumlein).

291-662-(121). Dendroica blackburniæ. (*Gmel.*). *Blackburnian Warbler; Orange-throated Warbler; Hemlock Warbler.

Rare; "rare migrant in Monroe Co." (Jerome Trombley); "taken in its southern migrations at Heisterman's Island" (N. A. Eddy); rare in summer: throughout the Southern Peninsula; "summer resident and migrant at Mackinac Island" (S. E. White); "common migrant at Palmer, Marquette Co." (O. B. Warren); "common at Iron Mountain" (E. E. Brewster); "Hillsdale and Lenawee Counties" (A. H. Boies); "DeWitt" (Dr. G. W. Topping); A. B. Cook took one male and two females of this handsome Warbler at the college May 18, the only ones seen up to this date, May 26, 1893; "rather common migrant in Wayne Co., and few breed on Keweenaw Point" (E. W. Durfee); breeds north; "nests in Northern Peninsula" (Prof. Ludwig Kumlein); "has been found breeding in Southern Michigan where nests have been taken in pine trees, at an elevation of forty feet" (Davie's Nests and Eggs of North American Birds, p. 373); "B. F. Syke found two nests in Kalamazoo Co., both quite high in tamarack trees" (Dr. M. Gibbs).

292-663 (129). Dendroica dominica *Linn.*). Yellow-throated Warbler.

Mr. Robt. H. Wolcott informs me that this species has been reported for years as occurring along Huron River below Ypsilanti, in Washtenaw Co., and was taken there in the spring of 1893 by Mr. A. B. Covert.

293 663a (130). **Dendroica dominica albilora** *Baird.* Sycamore Warbler; White-browed Yellow-throated Warbler.

Rare: "early migrant" (Dr. M. Gibbs); "rather rare summer resident, breeds, nests in tall sycamores on Raisin River" (Jerome Trombley); Dr. M. Gibbs writes me that he has found one nest in Kalamazoo Co.; "said to be often common about Detroit" (Butler's Birds of Indiana).

Black-throated Green Warbler, natural size.

294-667-(112). Dendroica virens (*Gmel.*). *Black-throated Green Warbler.

April and May, and August and September; usually a migrant south; nests north of Montcalm Co.; "I have taken one set of eggs at Port Sanilac" (W. A. Oldfield); "breeds sparingly in Kent Co. but abundantly at Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "breeds at Palmer, Marquette Co." (O. B. Warren); "taken in spring at Iron Mountain" (E. E. Brewster); "nests abundantly in Northern Peninsula" (Prof. Ludwig Kumlein); "breeds in Northern Michigan" (Davie's Nests and Eggs of North American Birds). This bird has been taken in Montcalm Co. by Dr. J. B. Steere, and in Ionia Co. by Mr. Levi Broas.

295-670-(131). Dendroica kirtlandi *Baird.* Kirtland's Warbler.

"Rare straggler" (Dr. M. Gibbs); "one from Battle Creek May 11, 1883, identified by Robt. Ridgway; taken by Mr. Knapp at Ann Arbor, May, 1888" (The Auk, Vol. VI, p. 279); one from Straits of Mackinaw, identified by Dr. C. Hart Merriam (The Auk, Vol I, pp. 376 and 389); in 1879 nine specimens known, the fifth and ninth taken by A. B. Covert in Washtenaw Co. (H. A. Purdie in Bull. Nuttall Ornithological Club, Vol. IV, p. 185); reported by Dr. C. Hart Merriam from Straits of Mackinaw, May 21, 1885 (The Auk, Vol. I, p. 376).

296-671-(134). Dendroica vigorsii (*Aud.*). *Pine Warbler; Pine-creeping Warbler.

April and May and September and October; J. E. Nichols of Lansing has taken these often in October; "not observed in Monroe Co." (Jerome Trombley);

"very common at Iron Mountain, and probably a summer resident" (E. E. Brewster); breeds north; "nests at Traverse City" (L. Whitney Watkins); "found all summer in Kent Co., probably breeds, and rare migrant at Mackinac Island" (S. E. White); "occasional in spring at Port Sanilac" (W. A. Oldfield); "song resembles that of Sparrow and is not Warbler like" (Dr. M. Gibbs).

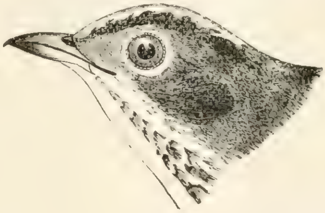
297-672-(132). Dendroica palmarum (*Gmel.*). *Palm Warbler; Yellow Red-polled Warbler; Wag-tailed Warbler; Titlark Warbler.

Very common migrant; May and October; flocks; "very common migrant in Wayne Co." (E. W. Durfee); "common migrant at Albion" (O. B. Warren); "occurs as a migrant at Mackinac Island" (S. E. White); E. E. Brewster has taken it at Iron Mountain; one of our most common and beautiful migrants.

298-673-(127). Dendroica discolor (*Vieill.*). Prairie Warbler.

"Rare migrant, breeds north of 44° north latitude" (Dr. M. Gibbs); "not observed in Monroe Co." (Jerome Trombley); "breeds in Michigan" (Davie); Dr. M. Gibbs writes me that he has taken the eggs; found a very common migrant at Mackinac Island by S. E. White who has specimens taken there; Prof. J. A. Allen writes me that this bird does not go north of Central Michigan; Dr. M. Gibbs collected nest and two eggs May 26, 1879, in Ottawa Co. (Bul. Nutt. Orn. Club, Vol. IV, p. 186).

Genus SEIURUS Swains.



Oven Bird, natural size.

299-674-(135). Seiurus aurocapillus (*Linn.*). *Oven Bird; Golden-crowned Thrush; Wood Wagtail.

Very common; throughout the Southern Peninsula at least; April to September, rarely to October; "usually seen on the ground" (Prof. J. W. Simmons); "abundant at Ann Arbor" (Dr. J. B. Steere); "common summer resident at Albion and St. Joseph" (O. B. Warren); "common in Lenawee and Hillsdale Counties" (A. H. Boies); "Port Sanilac, rare" (W. A. Oldfield); "rare at Bay City, taken at Heisterman's Island" (N. A. Eddy); "Mackinac Island" (S. E. White); taken at Iron Mountain by E. E. Brewster; "not uncommon on Keweenaw Point in summer" (E. W. Durfee); breeds; nests in June on the ground, often under a log; nest oven-like, hence common name of bird; nests common near marshes about the college; eggs four to six. This bird is retiring and usually found in dense thickets; "sings at all times of night" (Samuels). When we drive this bird from the nest it feigns lameness and flutters away to lure us from its eggs and young. This bird rears very numerous Cow Birds.

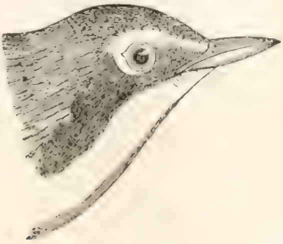
300-675-(136). Seiurus noveboracensis (*Gmel.*). *Water Thrush; Small-billed Water Thrush; Water Wagtail.

Rare; migrant; April and May; "rare transient in Kalamazoo Co." (Dr. M. Gibbs); "Port Sanilac, rare" (W. A. Oldfield); "very rare in Kent Co., one taken May 9, 1891" (S. E. White); "one taken August 29, 1888, at Heisterman's Island" (N. A. Eddy); "Keweenaw Point" (Kneeland); "taken in Hillsdale Co." (A. H. Boies); "rare in Monroe Co." (Jerome Trombley); frequents dense thickets in swamps; "breeds in Northern Indiana where it is a rare summer resident" (A. W. Butler); nests in June, among roots of turned up trees, in marshes or under stumps, logs, etc.; eggs four to six, delicate cream, densely specked with reddish brown.

301-676-(138). Seiurus motacilla (*Vieill.*). *Louisiana Water Thrush; Large-billed Wagtail Warbler.

Not uncommon, especially in the southern part of the state; April to August; "common in Kalamazoo Co." (Dr. M. Gibbs); "rather common summer resident in Wayne Co." (E. W. Durfee); "very common in Kent Co." (S. E. White); breeds; nests on the ground, under logs, or as in the preceding species; eggs as in the preceding. Mr. Jerome Trombley writes me that this is the common "Water Thrush" of Monroe Co.

Genus GEOTHLYPIS Cab.



Kentucky Warbler, natural size.

302-677-(140). Geothlypis formosa (*Wils.*). *Kentucky Warbler.

Exceedingly rare; Dr. Atkins reports taking one specimen June 24, 1878; Dr. M. Gibbs reports one specimen taken by him in Kalamazoo Co.

303-678-(139). Geothlypis agilis (*Wils.*). *Connecticut Warbler.

Exceedingly rare, but becoming more common; "one of our rarest Warblers" (Dr. M. Gibbs); May and June; migrant; "first taken May, 1879, in Kalamazoo, Washtenaw, Ottawa and Ingham Counties within a week" (Dr. M. Gibbs); "two taken at Heisterman's Island September 2, 1889" (N. A. Eddy); "one taken August 30, 1889, and the same date in 1890, at Mackinac Island, and one taken a week later in Kent Co." (S. E. White); Mr. Charles W. Gunn reports one from Ingham and one from Ottawa Co. (Bull. Nuttall Ornithological Club, Vol. IV, p. 123); this is one of the latest Warblers to arrive in the spring.

304-679-(142). Geothlypis philadelphia (*Wils.*). *Mourning Warbler.

Occasionally quite common; May to August; "Hillsdale and Lenawee Counties" (A. H. Boies); "have taken one at Port Sanilac" (W. A. Oldfield); "migrant at

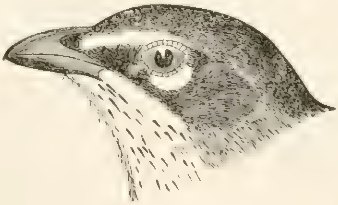
Plymouth" (J. B. Purdy); "rare in Monroe Co." (Jerome Trombley); "rare in Kalamazoo Co." (Dr. M. Gibbs); "very rare at Mackinac Island" (S. E. White); embraced in Cabot's Birds of Lake Superior; "Iron Mountain, May 1888" (E. E. Brewster); "not rare on Keweenaw Point" (E. W. Durfee); "breeds north on edge of pinery" (Dr. M. Gibbs). Dr. Gibbs writes me that it is abundant in second growth clearings in the pine regions north of 44 degrees north latitude; nest and eggs as in next species; taken here by A. B. Cook, May 17, 1893.

Maryland Yellow-throat, male, natural size.

305-681-(141 part). Geothlypis trichas (*Linn.*). * MARYLAND YELLOW-THROAT; YELLOW-THROATED GROUND WARBLER.

Very common; throughout the state; May to August; "abundant at Ann Arbor" (Dr. J. B. Steere); "common but not abundant at Bay City" (N. A. Eddy); "common at DeWitt" (Dr. G. W. Topping); reported from Hillsdale and Lenawee Counties, and at Sault Ste. Marie July 16, 1892, by A. H. Boies, who thinks it breeds in the Northern Peninsula; "not a common migrant at Mackinac Island" (S. E. White); "common summer resident at Albion, and also at Palmer where it surely breeds" (O. B. Warren); "common at Iron Mountain" (E. E. Brewster); breeds; "two broods" (Dr. W. C. Brownell); nests from May to July, on the ground or in low thickets; nests often arched over; eggs four to six, clear white specked with reddish dots, though quite variable in size, form and markings; one of our finest singers and justly a favorite.

GENUS ICTERIA VIEILL.



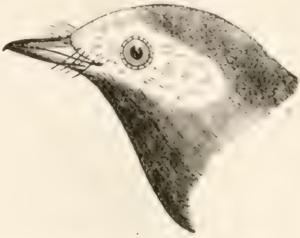
Yellow-breasted Chat.

306-683-(144). Icteria virens (*Linn.*). * YELLOW-BREASTED CHAT.

Exceedingly rare; "occasionally quite common" (Dr. H. A. Atkins); "not observed at Ann Arbor" (Dr. J. B. Steere); "once in Lenawee Co." (A. H. Boies); "formerly nested in Monroe Co., not seen since 1881" (Jerome Trombley); May to October; breeds; nests in May and June in bushes; eggs four;

song varied and beautiful; "ventriloquist" (Butler's Birds of Indiana); "this is a southern species" (Prof. J. A. Allen).

GENUS SYLVANIA NUTT.



Hooded Warbler, natural size.

307-684-(146). Sylvania mitrata (*Gmel.*). *HOODED WARBLER; HOODED FLY-CATCHING WARBLER.

Quite common in southern part of state; generally a migrant; May and October; "breeds plentifully south of 42°, have taken many nests" (Dr. M. Gibbs); "common but transient in Monroe Co." (Jerome Trombley); nests in May in low bushes; "eggs three, often only two" (Dr. M. Gibbs); an elegant bird.

308-685-(147). Sylvania pusilla (*Wils.*). WILSON'S WARBLER; GREEN BLACK-CAPPED YELLOW WARBLER.

"Tolerably common in Northern Indiana" (Butler's Birds of Indiana); "exceedingly abundant migrant at Mackinac Island and in spring in Kent Co." (S. E. White); N. A. Eddy has taken a single specimen at Heisterman's Island, Saginaw Bay; E. E. Brewster writes me that it is common at Iron Mountain; "often common migrant in Monroe Co." (Jerome Trombley); "common migrant in Michigan" (Dr. M. Gibbs); I have never taken this bird about the college.

Canadian Flycatching Warbler, natural size.

309-686-(149). Sylvania canadensis (*Linn.*). *CANADIAN WARBLER; CANADIAN FLYCATCHING WARBLER.

Not rare; migrant; April and May and August and September; N. A. Eddy took a nest and four eggs together with the female at Bay City, June 2, 1885; "rather common in Kalamazoo Co." (Dr. M. Gibbs); "Lenawee Co." (A. H. Boies); "common migrant in Monroe Co." (Jerome Trombley); "Iron Mountain" (E. E. Brewster);

"common migrant in summer, and to be seen in the deep wooded ravines on Keweenaw Point at any time in the summer season" (E. W. Durfee); "Keweenaw Point" (Kneeland); "common summer resident at Mackinac Island" (S. E. White); probably breeds in Northern Peninsula; nests in June on the ground; eggs four or five.

GENUS SETOPHAGA SWAINS.

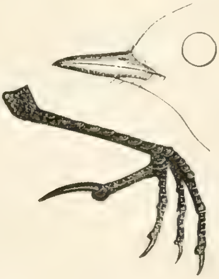
310-687-(152). Setophaga ruticilla (*Linn.*). *AMERICAN REDSTART.

Very common; throughout the entire state; May to August; "occurs in amazing abundance at Mackinac Island" (S. E. White); "rare at Iron Mountain" (E. E. Brewster); "breeds commonly on Keweenaw Point" (E. W. Durfee); "all my records are for spring migrations when it is abundant at Bay City" (N. A. Eddy); "common summer resident at Albion and St. Joseph, and seen at Palmer where it is a common migrant, a few remaining to breed" (O. B. Warren); breeds; nests in June in small trees, usually twelve to twenty feet from the ground, rarely forty feet; "nests at Manchester, neatly woven in vertical crotch of shrubs about twelve feet high" (L. W. Watkins); nests usually found in thick woods or dense swamps; "breeds abundantly at Ann Arbor" (Dr. J. B. Steere). Dr. Atkins gives dates of its arrival for twenty-six years in O. and O., Vol. VIII, p. 31.

FAMILY MOTACILLIDÆ. WAGTAILS AND PIPITS.

Small birds; insectivorous; often in flocks.

GENUS ANTHUS BECHST.



Titlark, natural size.

311-697-(89). Anthus pensilvanicus (*Lath.*). *AMERICAN PIPIT; AMERICAN TITLARK; WAGTAIL; BROWN LARK; PIPIT.

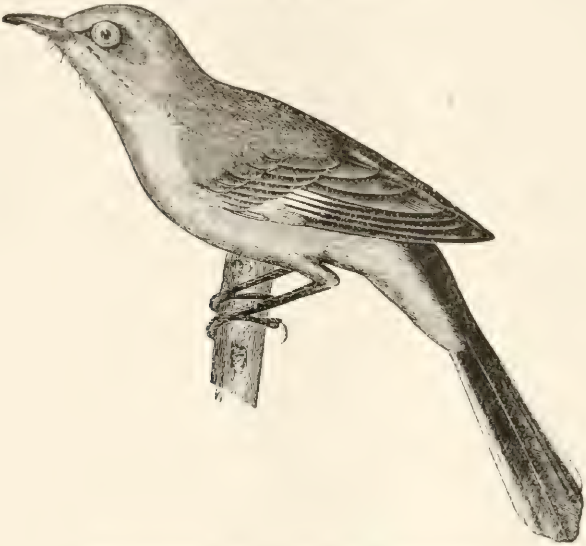
Common; throughout the state; in flocks; April and May and September to November, occasional in December and January; migrant; taken at college by A. B. Cook in May, 1893; "common at Bay City during fall migrations" (N. A. Eddy); "common at Iron Mountain in autumn and probably in spring" (E. E. Brewster); "Keweenaw Point" (Kneeland); "rare migrant at Albion" (O. B. Warren); "winter sojourner" (A. H. Boies). Taken here by L. W. Watkins, May 10, 1893.

FAMILY TROGLODYTIDÆ. WRENS; THRASHERS, ETC.

Insectivorous birds; often sweet singers.

SUBFAMILY MIMINÆ. THRASHERS.

GENUS MIMUS BOIES.



Mocking Bird, about two-thirds natural size.

312–703–(15). Mimus polyglottos (*Linn.*). *MOCKING BIRD.

Possibly a rare accidental straggler from the south. One reported by E. L. Moseley. This species is included in the manuscript list of the Birds about Detroit, by the late Rev. Chas. Fox. Hon. Bela Hubbard in his "Memorials of a Half Century," p. 310, says, "seen, though but rarely, in this state."

GENUS GALEOSCOPTES CAB.

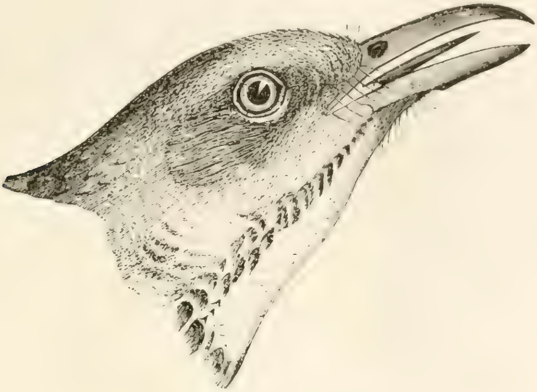
Cat-bird, natural size.

313–704–(16). Galeoscoptes carolinensis (*Linn.*). *CAT-BIRD.

Very common; throughout the state; usually in woodlands, though here at the college where we protect the birds, they even breed freely on the campus; Mr.

Robt. H. Wolcott found a nest at New Baltimore July 23, 1893, in maple tree twenty feet from the ground; April and May to September; "Mackinac Island" (S. E. White); "rare at Iron Mountain" (E. E. Brewster); "not seen at Palmer, Marquette Co., but very common at Albion and St. Joseph" (O. B. Warren); breeds; nests in shrubs; eggs four, rarely five,, deep green; song pleasing and varied.

GENUS HARPORHYNCHUS CAB.



Brown Thrush, natural size.

314-705-(17). Harporhynchus rufus (*Linn.*). *BROWN THRUSH; BIG BROWN WREN; BROWN THRASHER; BROWN MOCKING BIRD.

Very common, especially south; April to September; "Grand Traverse Co." (M. L. Leach); "April 28, 1891, at Grand Rapids" (E. B. Boies); "nests abundantly at Bay City, where it arrives the last two weeks of April" (N. A. Eddy); "Mackinac Island" (S. E. White); "not seen in Upper Peninsula" (A. H. Boies); "very common at Iron Mountain. where with many other song birds they suffer seriously at the hands of the Italians, who kill them for stews" (E. E. Brewster); not shy; strong singers; "song wonderfully rich, melodious and varied" (L. S. Foster); breeds; "nests at Palmer, Marquette Co., and very common on Escanaba River, nine miles from Palmer, as it is at Albion and St. Joseph" (O. B. Warren); nests in bushes. occasionally on the ground; nests rude, coarse and bulky; eggs three to five, dirty white, specked with brown; food, small fruits and insects; "Forbes found twenty-three per cent of food which he examined to be canker worms" (Report State Horticultural Society, 1891, p. 204); like the Robin. this bird often returns to the same place year after year.

SUBFAMILY TROGLODYTINÆ. WRENS.

GENUS THRYOTHORUS VIEILL.

315-718-(68). Thryothorus ludovicianus (*Lach.*). CAROLINA WREN.

Rare summer resident in southern part of the state; "Lenawee Co." (A. H. Boies); Jerome Trombley finds it a rare summer resident in Monroe Co.. where he took a nest in 1892, beneath the roots of a fallen tree, with six eggs in it; "northern counties of Indiana" (Butler's Birds of Indiana); said to breed at nearly all seasons. We have never seen it here. J. B. Purdy says it does not breed at Plymouth.

Carolina Wren.

316-719-(71). Thryothorus bewickii (*Aud.*). BEWICK'S WREN.

"Very rare, in spring" (Dr. M. Gibbs); very rare; "summer resident in Monroe Co., where it has nested three years in a bird box, identification certain" (Jerome Trombley); "rare, but several taken in Kalamazoo Co." (Dr. M. Gibbs); we have never taken this here, and J. B. Purdy says the same of Plymouth.

GENUS TROGLODYTES VIEILL.

317-721-(74). Troglodytes aëdon (*Vieill.*). HOUSE WREN.

Very common in some localities; April to October; "abundant at Grand Rapids" (E. B. Boies); "becoming rare at Plymouth" (J. B. Purdy); "not rare at Ann Arbor" (Dr. J. B. Steere); "not seen in Upper Peninsula" (A. H. Boies); "Mackinac Island" (S. E. White); "very common at Palmer, Marquette Co., where it nests in shaft houses, one a few feet from where the ship dumped a ton of ore each raise. The great noise seemed no disturbance to the Wren" (O. B. Warren); "common at Iron Mountain" (E. E. Brewster); "not uncommon on Keweenaw Point" (E. W. Durfee); breeds; nests in holes in trees and stumps; "extensively in lumber piles, which line the Saginaw river for miles on either side" (N. A. Eddy); in niches under porches, boxes, etc., in June, occasionally second time in August; Mr. Robert H. Wolcott found a nest with fresh eggs at New Baltimore July 29, 1893; eggs four to ten, white, thickly specked with reddish brown. This bird is very rare at Lansing, especially since the advent of the English Sparrow, but "very common at Traverse City" (L. W. Watkins); "abundant at Albion and St. Joseph" (O. B. Warren); "this bird leaves the vicinity of our dwellings after breeding" (L. S. Foster). This little Wren nested in my whirling horse-tether box, and repaired its nest time after time, as it would be destroyed by the turning of the box—there were six eggs; "song loud and hearty, scolds vigorously at intrusion" (E. L. Moseley).

Winter Wren, slightly reduced.

318-722-(76). Troglodytes hiemalis *Vieill.* *WINTER WREN.

Common migrant; "transient in Monroe Co., seen oftener in spring than in fall" (Jerome Trombley); "migrant at Plymouth" (J. B. Purdy); "very common in spring, summer and fall, and occasionally in late winter, breeds" (Dr. M. Gibbs); reported by S. E. White at Grand Rapids, June 11, 1891; "occasionally seen in spring migrations at Bay City" (N. A. Eddy); "common at Albion, and common summer resident at Palmer" (O. B. Warren); "rare at Ann Arbor" (Dr. J. B. Steere); it is very rare at Lansing; "Kent Co., where it breeds, and Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); rather shy; "breeds in Upper Peninsula" (Prof. Ludwig Kumlein); E. W. Durfee took a nest near Grand Rapids; "nesting habits much as in last species" (Davie's Nests and Eggs of North American Birds, p. 407); though it may nest in brush-piles, etc.; nest lined with feathers; eggs four to nine, white, minutely specked with brown: feeds on insects and insects' eggs.

GENUS CISTOTHORUS CAB.

Short-billed Marsh Wren, natural size.

319-724-(81). Cistothorus stellaris (*Licht.*). *SHORT-BILLED MARSH WREN.

Rather common; summer; "rare at Ann Arbor" (Dr. J. B. Steere); "Lenawee Co." (A. H. Boies); "common in marshes at the west end of Lake Erie" (Jerome

Trombley); "breeds in Sanilac Co. marshes" (W. A. Oldfield); "breeds; nests in July; nesting habits as in next species, except that it nests in clear places and in moist meadows, not over water" (R. H. Wolcott); and the nest is formed of fresh reeds and flags and beautifully lined with cotton like down; "common at St. Joseph and Albion" (O. B. Warren); E. W. Durfee finds nests not uncommon in Wayne Co.; eggs six to nine, white. Mr. E. W. Durfee states that these, like the next species, make two or three duplicate nests.

Long-billed Marsh Wren, natural size.

320-725-(79, 80). Cistothorus palustris (*Wils.*). *Long-billed Marsh Wren.

Rather common in summer; "rare at Ann Arbor" (Dr. J. B. Steere); "St. Joseph Co." (A. H. Boies); "abundant in the marshes at the west end of Lake Erie" (Jerome Trombley); "breeds abundantly in all the marshes about Bay City and at Heisterman's Island" (N. A. Eddy); "nests found in Wayne Co." (E. W. Durfee); breeds; Robt. H. Wolcott found nest with eggs at New Baltimore August 6, 1893; nests in colonies, near the ground, in marshes, in spherical nests of coarse grass, etc.; "fastened to old flags two or three feet above the water or mud" (E. L. Moseley), the opening on the side; "Mr. A. B. Covert found two nests together at Ann Arbor in 1892" (R. H. Wolcott); eggs five to ten, very small, dark chocolate brown, rarely almost white; "while the female is sitting the male partially builds one or more nests" (Dr. A. K. Fisher); Dr. W. C. Brownell writes me that there are sometimes eight of these duplicate and unlined nests.

Family CERTHIIDÆ. Creepers.

Small, narrow-billed birds; seen creeping up tree trunks; food insects and insects' eggs.

Genus CERTHIA Linn.

321-726-(62 part). Certhia familiaris americana (*Bonap.*). *Brown Creeper; American Creeper.

Rather common; throughout the entire state; all seasons; "does not breed at Plymouth" (J. B. Purdy); "I have found them nesting in Kent Co., and they are not rare on Keweenaw Point" (E. W. Durfee); "rather rare at Ann Arbor" (Dr. J. B. Steere); "formerly nested in Monroe Co., now only a migrant, found a nest behind loose bark of a tree in 1865" (Jerome Trombley); "very common migrant at St. Joseph and Albion" (O. B. Warren); "Bay City from April 3 to

18. taken in pine forests north in November, and at Heisterman's Island in June" (N. A. Eddy); "rather common in Kent Co. in summer and at Mackinac Island" (S. E. White); "common at Iron Mountain" (E. E. Brewster); breeds; "nests between loosened bark and tree" (Dr. A. K. Fisher); "under bark of stub thirty feet high in Ottawa Co." (Dr. M. Gibbs); taken by O. B. Warren at Palmer, September 11, 1893; see Davie's Nests and Eggs of North American Birds, p. 410; in May; eggs five to eight, white, specked with brown. This bird climbs spirally up tree trunks.

Head, foot and tail-feather of Certhia, natural size.

Family PARIDÆ. Nuthatches and Tits.

Food insects and insects' eggs; they creep up tree trunks and along limbs much as do the Sapsuckers and Creepers, except they usually go downwards head foremost as they hunt for their food. They are exceedingly valuable birds.

Subfamily SITTINÆ. Nuthatches.

Genus SITTA Linn.

322-727-(57). Sitta carolinensis *Lath.* *White-breasted Nuthatch; Tomtit; White-bellied Nuthatch.

Common; throughout the entire state; every month of the year; "common at Ann Arbor" (Dr. J. B. Steere); "more common in fall and spring than the next species at Bay City, often seen in winter, breeds at Heisterman's Island" (N. A. Eddy); "never seen at Iron Mountain, Upper Peninsula" (E. E. Brewster); "very rare at Mackinac Island" (S. E. White); "not seen at Palmer but a common resident at Albion and St. Joseph" (O. B. Warren); "very common and breeds in Wayne Co. where I once took a set of eleven eggs, and I have seen a pair at Ishpeming" (E. W. Durfee); breeds; nests in April; nests usually made in ready formed holes in trees from ten to fifty feet from the ground; eggs four to eight, rarely nine or ten, white to roseate, specked with brown; this bird is often seen creeping down trees head foremost; will place acorns containing weevil grubs in some cavity in bark to hold them secure and then pick out the delicate tit-bit.

323-728-(59). Sitta canadensis *Linn.* *Red-breasted Nuthatch; Red-bellied Nuthatch; Canada Nuthatch.

Rather rare; more common north; "rare fall and spring migrant in Monroe Co., none remaining to breed" (Jerome Trombley); "rare in Wayne Co." (B. H. Swales); "common during migration" (E. L. Moseley); "rarely seen at Ann

Arbor" (Dr. J. B. Steere); "does not breed at Plymouth" (J. B. Purdy); "very common at Iron Mountain in the Upper Peninsula" (E. E. Brewster); "taken at Palmer September 11, 1893" (O. B. Warren); "usually a rare migrant in Wayne Co., but in the spring of 1889 they were abundant, and not a rare summer resident on Keweenaw Point" (E. W. Durfee); "Keweenaw Point" (Kneeland); "abundant at Mackinac Island, and occurs in winter in vast flocks, in Upper Peninsula, in Iron Co." (S. E. White); "breeds" (Dr. M. Gibbs); nests and eggs as in the preceding species except that the eggs are slightly smaller; we find this more rare here than the preceding species.

Red-bellied Nuthatch, natural size.

SUBFAMILY PARINÆ. TITMICE.

GENUS PARUS LINN.

324 731 (40). **Parus bicolor** (*Linn.*). *TUFTED TITMOUSE; SUGAR BIRD; BLACK-FRONTED TITMOUSE.

Common in more southern parts of the state; winter; occasional in April and May and September; "is regular winter resident at Ann Arbor" (Dr. J. B. Steere); "common in Lenawee and Hillsdale Counties" (A. H. Boies); "took specimens in August, 1891, at Port Sanilac" (W. A. Oldfield); "every year in Monroe Co. often until late May" (Jerome Trombley); "Benjamin Syke found this abundantly in Van Buren Co. one year" (Dr. M. Gibbs); "only taken once at Plymouth" (J. B. Purdy); "rarely found north of 40 degrees" (H. Nehrling); "summer resident in northern counties of Indiana" (Butler); Dr. Atkins reports taking this in April and May at Locke; we have taken it at this place; two specimens taken by Stewart E. White in Kent Co. in June, 1891; these valuable birds

Tufted Titmouse, natural size.

eat a great many leaf rollers and other insects during the winter season; J. E. Nichols, of Lansing, has this bird in his collection taken in September, 1881; he has often taken it about Lansing in fall and spring.

325 735-(44). Parus atricapillus *Linn.* *CHICKADEE; BLACK-CAPPED CHICKADEE.

Very common; throughout the entire state; every month of the year; "very common at Ann Arbor" (J. B. Steere); "resident in Monroe Co., but much more common in winter" (Jerome Trombley); "no summer record at Bay City, but found at all other seasons" (N. A. Eddy); "Grand Traverse Co." (M. L. Leach); "common resident at Albion and St. Joseph, and seen every month of the year at Palmer, Marquette Co." (O. B. Warren); "Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "very common at Iron Mountain" (E. E. Brewster); "common at Bay City in the spring, 1884" (N. A. Eddy in O. and O., Vol. IX, p. 41); breeds; nests in a hole in a tree or stump; "breeds year after year in same nest where they may roost in winter" (Dr. W. C. Brownell); "breeds at Traverse City" (L. W. Watkins); "have found full sets of eggs in winter" (Dr. W. C. Brownell); eggs five or six, eight taken by Gilbert White in Kent Co., May, 1892, ten young found in nest by F. M. Falconer, white specked with brown; "this bird is very familiar, may alight on a person" (E. L. Moseley, Forest and Stream, September, 1886); Dr. Atkins reported seeing them eat tent caterpillars extensively.

Black-capped Chickadee, reduced.

326-740-(49). Parus hudsonicus *Forst.* HUDSONIAN CHICKADEE.

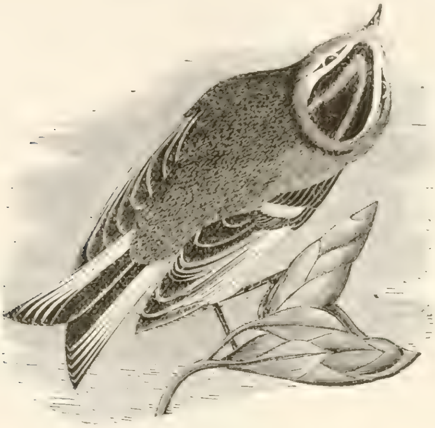
Rare; "Northern Michigan" (Dr. A. K. Fisher); "a rare winter resident of Northern Michigan" (H. Nehrling); "Keweenaw Point" (Kneeland); in Cabot's list of Birds of Upper Peninsula.

FAMILY SYLVIIDÆ. WARBLERS; KINGLETS; GNATCATCHERS.

Small, beautiful, insectivorous birds; feed largely on insects and insects' eggs.

SUBFAMILY REGULINÆ. KINGLETS.

GENUS REGULUS CUV.



Golden-crowned Kinglet.

327–748–(34). Regulus satrapa *Licht.* *GOLDEN-CROWNED KINGLET; GOLDEN-CROWNED WREN; GOLDEN-CRESTED KINGLET.

Common; migrant; March to May, and October and November; occasionally a winter resident; "more common at Ann Arbor than the next species" (Dr. J. B. Steere); "abundant spring and fall migrant at Bay City and without doubt a winter resident of pineries north" (N. A. Eddy); "more timid and retiring than the next species and comes and goes in flocks; probably does not breed in Southern Michigan" (A. H. Boies); "saw them at Plymouth, but they do not breed here" (J. B. Purdy); "Grand Rapids, April 14, 1891" (E. B. Boies); common in winter in Wayne Co." (B. H. Swales); "abundant migrant in Kent Co." (S. E. White); "common migrant at Albion and St. Joseph where it arrives very early, and common at Palmer, Marquette Co." (O. B. Warren); found in woods; "common at Iron Mountain" (E. E. Brewster); included in Cabot's Birds of Lake Superior; found breeding at Ontonagon by Prof. Ludwig Kumlein; "breeds abundantly at Mackinac Island in July" (S. E. White); "eggs four to nine, occasionally ten" (Prof. A. W. Butler); "nine" (E. E. Brewster); cream color or creamy white, specked with brown.

328–749–(33). Regulus calendula (*Linn.*) *RUBY CROWNED KINGLET.

Rather common; throughout the state; migrant; April and May, and October and November; "rare at Ann Arbor" Dr. J. B. Steere); "Dewitt" (Dr. G. W. Topping); "abundant spring and fall migrant at Bay City" (N. A. Eddy); "common at Iron Mountain" (E. E. Brewster); breeds in the Northern Peninsula; "nests with five young at Mackinac Island, July 26, 1890" (S. E. White);

"common in spring migrations at Albion, St Joseph and Palmer" (O. B. Warren); "breeds at L'Anse" (Prof. Ludwig Kumlein); "nests semipensile in trees" (Coues' North American Birds); "eggs five to nine, dull whitish, or pale buff, faintly spotted with light brown, chiefly at the larger end" (Davie); "often found in flocks with the preceding species" (Prof. J. W. Simmons); this and the preceding species are two of our most elegant birds. This species is not shy.

SUBAMILY POLIOPTILINÆ. GNATCATCHERS.

GENUS POLIOPTILA SCLAT.

Blue-gray Gnatcatcher, natural size.

329-751-(36). Polioptila cærulea (*Linn.*). * BLUE-GRAY GNATCATCHER.

Very common; throughout Southern Michigan; April to September; "very common at Ann Arbor" (Dr. J. B. Steere); we find it common at this place; S. E. White reports it rare at Mackinac Island and says it is found in the Northern Peninsula; "common at Albion, and very common at St. Joseph in 1884 and 1885, but less so since" (O. B. Warren); breeds; nests in trees in May; nest elegant, softly lined and covered outside with lichens; often secures material for nest from nests of other birds; eggs four to seven, white, specked with brown; habits much like those of Creepers and Nuthatches.

FAMILY TURDIDÆ. THRUSHES, BLUE BIRDS, ETC.

Food principally insects, often fruit; usually sweet singers.

SUBFAMILY TURDINÆ. THRUSHES.

GENUS TURDUS LINN.

330-755-(6). Turdus mustelinus (*Gmel.*). * WOOD THRUSH; SONG THRUSH.

Not rare; throughout the state; April and May to October; numbers decreasing as the thickets are cleared up; "occurs at Mackinac Island" (S. E.

White); "no record at Bay City, but taken at Heisterman's Island, Saginaw Bay" (N. A. Eddy); "rare at St. Joseph, common at Albion, and very common at Palmer, Marquette Co., the first to come and go" (O. B. Warren); "Keweenaw Point" (Kneeland); breeds at least in Southern Peninsula; nests in May and June

Wood Thrush, natural size.

in trees or shrubs, "in orchards" (Dr. A. K. Fisher); I have found the nests more commonly in damp, thick woods, and generally on low beech limbs; "nest at Traverse City" (L. W. Watkins); eggs like those of the Robin, except a trifle smaller, two to five; "this bird is shy during molt" (Dr. A. K. Fisher); and is usually seen in dense wood-lands and thickets; the food habits of the Wood Thrush are much the same as those of the Robin.

331-756-(7). Turdus fuscescens *Steph.* *Wilson's Thrush; Veery; Tawny Thrush.

Common at least in southern part of the state; throughout the Lower Peninsula; April to September; usually in swampy woods; "found everywhere and breeds in abundance at Bay City" (N. A. Eddy); "Keweenaw Point" (Kneeland); "occurs at Mackinac Island" (S. E. White); Mr. White informs me that it breeds in Kent Co.; "rather common at St. Joseph" (O. B. Warren); breeds; "have seen them very abundant in Wayne Co., where they breed abundantly" (Dr. W. C. Brownell); nests on ground, occasionally in low shrubs or clumps of bushes, in May or June; eggs blue, four, occasionally five.

332-757-(12). Turdus aliciæ *Baird.* *Gray-cheeked Thrush.

One reported from Michigan in the museum of the Kent Scientific Institute by E. L. Moseley; taken in Kent Co., and one specimen at Mackinac Island by S. E. White; N. A. Eddy reports one at Heisterman's Island, Saginaw Bay, September 4, 1888; "one taken at Locke May 10, 1883" (Dr. H. A. Atkins); "this bird is recorded from Kalamazoo Co. by F. H. Chapin and from Kent Co. by Mr. Chas. W. Gunn" (Dr. M. Gibbs).

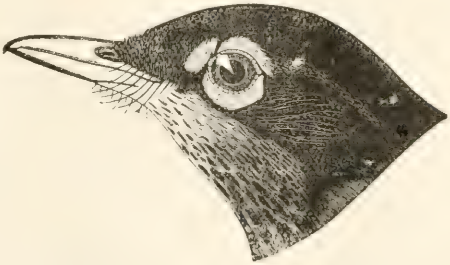
333-758a-(13). Turdus ustulatus swainsonii (*Cab.*). *Olive-backed Thrush; Swainson's Thrush; Swamp Robin.

Common; throughout the Southern Peninsula if not the entire state; May to October; E. B. Boies reports a large flock at Grand Rapids, April 17 and 18, 1821 (Was not this the Hermit Thrush?); "abundant in fall at Heisterman's Island, Saginaw Bay" (N. A. Eddy); "rare in Wayne Co." (B. H. Swales); "Lenawee Co." (A. H. Boies); "rare and transient in Monroe Co." (Jerome Trombley); "common summer resident at Mackinac Island" (S. E. White); "Keweenaw Point" (Kneeland); "common migrant at Albion, and common at Palmer" (O. B. Warren); breeds north; "breeds most abundantly of any Thrush on Keweenaw Point, the nesting habits like Wood Thrush" (O. B. Warren); we have never found it nesting here; J. B. Purdy, of Plymouth, has never seen or found a nest at that place; Dr. M. Gibbs reports taking nests and eggs in Kalamazoo Co.; (Is not this a mistake?) nests in low shrubs in June; nest compact with no mud; eggs four, bluish green, and peculiar in being specked with varying shades of brown; this bird is a sweet and almost continuous singer. Dr. M. Gibbs gives an excellent description of this bird and its nesting and migration in O. and O., Vol. X, 1885, p. 26.

334 759b-(10). Turdus aonalaschkæ pallasii (*Cab.*). *HERMIT THRUSH; CATHEDRAL BIRD; RUFUS-TAILED THRUSH; GROUND SWAMP ROBIN; SWAMP ANGEL.

April and May to October; "Monroe Co., common, transient" (Jerome Trombley); "abundant spring migrant at Bay City" (N. A. Eddy); "common at Mackinac Island" (S. E. White); "common summer resident at Palmer" (O. B. Warren); "Upper Peninsula" (H. Nehrling); "common at Iron Mountain" (E. E. Brewster); breeds north; "breeds on Keweenaw Point" (E. W. Durfee); nests taken in Montcalm Co., by Dr. Gibbs, June 23, 1882; also "in Ottawa Co., May 15, 1879, by W. A. Gunn" (Dr. M. Gibbs); nests in June, usually on the ground, "in July at Mackinac Island" (S. E. White), rarely in low shrubs; the nest loosely constructed and without mud; eggs three or four, light blue, immaculate. For interesting account of the habits of this bird, see article by Dr. M. Gibbs in O. and O., Vol. X, p. 27.

GENUS MERULA LEACH.



Robin, natural size.

335–761–(1). Merula migratoria (*Linn.*). *AMERICAN ROBIN; ROBIN.

Very common; throughout the entire state; "very common at Iron Mountain" (E. E. Brewster); March to October; rarely throughout the winter; "Grand Rapids February 28, 1892" (E. B. Boies); "passes Bay City south in large flocks late in September and early in October" (N. A. Eddy); retires in winter to protected localities and so is not so often seen; "Traverse City" (Dr. M. L. Leach); "common and shy at Mackinac Island" (S. E. White); "arrived at Palmer, Marquette Co., the last day of March, 1893. very common at St. Joseph, where it is shot extensively by orchardists who consider it a pest, at Albion an albino female occupied the same nest four successive years" (O. B. Warren); "Keweenaw Point" (Kneeland); occasionally albinos; I knew an albino female, presumably the same bird, to nest two successive summers in the same nest; breeds; often two brooded; R. H. Wolcott found a nest at New Baltimore with young in it on July 23, 1893; "always double brooded if undisturbed" (Dr. M. Gibbs); nests on fences, in trees, on ledges under eaves, in old nests, rarely of other birds, "in buildings" (O. and O., Vol. XIV, 1889, p. 43) etc.; eggs three to five, greenish blue, "rarely sprinkled with brown" (A. W. Butler); eats myriads of insects, mostly noxious species, angle-worms and fruit, cherries, berries and grapes; 40 per cent of the food of birds examined by Prof. Forbes (Report Michigan Horticultural Society, 1881, p. 204) was found to be canker worms.

GENUS SIALIA SWAINS.

Blue Bird, natural size.

336–766–(27). Sialia sialis (*Linn.*). *BLUE BIRD.

Common; throughout the entire state; less common than formerly; driven away by English Sparrows; February or March to November; "one of our earliest birds to arrive in the spring; "Grand Rapids, February 26, 1891" (E. B. Boies); "breeds abundantly at Bay City, but less common than previously" (N. A. Eddy); "Grand Traverse Co." (M. L. Leach); "occurs at Mackinac Island as a rare summer resident but abundant migrant" (S. E. White); "formerly very abundant at St. Joseph but now rare because of the aggressive English Sparrows, I have taken seven sets of albino eggs, rather rare at Palmer where I saw them come from the north in large flocks September 11, 1893" (O. B. Warren); "Keweenaw Point" (Kneeland); "very common at Iron Mountain" (E. E. Brewster); breeds; "double or triple brooded" (Prof. J. W. Simmons); nests in hollow trees, "either in holes which they excavate in rotten trees, or which other birds have excavated" (J. E. Nichols), in boxes, etc.; eggs four to six, light blue, rarely pure white; a very beautiful and valuable bird.

A. J. COOK,
Zoölogist.

AGRICULTURAL COLLEGE, }
April, 1893. }

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POTATOES.

No. 95—Farm Department.

HILLS VS. DRILLS.

BY C. J. BARNUM, '94, AND W. J. McGEE, '96.

The object of the experiment was to ascertain, if possible, which method of planting, in hills or in drills, gives the greater yield per acre.

The potatoes were planted May 31, 1892, each potato being cut in four pieces. Equal amounts of seed were used for equal areas, *i. e.*, the same amount of seed was used for an acre of hills as for an acre of drills.

The test was made with several varieties in order that each individual variety might not influence materially the general result. The various plats of hills and drills alternated with each other, securing as nearly uniform conditions as possible.

The following table gives in bushels per acre the general average resulting from 24 experiments:

TABLE 1.—*Comparative yields.*

Variety.	Drills.—Bu.	Hills.—Bu.
Early Ohio	207	195
Rural New Yorker No. 2	310	281

With the Early Ohio, out of a total of 12 experiments, 6 were in favor of hills, 5 in favor of drills and one experiment was indecisive.

With the Rural New Yorker No. 2, 9 out of 12 experiments favored the method of drills and three were in favor of hills.

Four other experiments were made with other varieties. 3 of which showed a balance in favor of drills while one gave the greater yield with the hill culture.

Thus we see out of a total of 28 experiments, 10 were in favor of hill culture and 17 in favor of drills. The general average, however, as shown by the above table, was in favor of drills.

Experiments along the same line were conducted by E. B. Hale during 1891. These experiments were quite extensive, being made with four different amounts of seed and each experiment was repeated three times to secure uniform and reliable results. Two varieties were used in this experiment and the result of the work is shown in the following table:

TABLE 2.—*Comparative yields.*

Variety.	Hills.—Lbs.				Drills.—Lbs.			
	One eye.	Two eyes.	One-half potato.	Whole potato.	One eye.	Two eyes.	One-half potato.	Whole potato.
Rural New Yorker No. 2	162	198	187	182	181	210	199	213
Pearl of Savoy	38	46	66	112	70	81	94	136

The numbers given in the preceding tables show that the yield was, in every instance, appreciably in favor of the method of drills. This experiment may be regarded as quite conclusive, as each number in the table is an average of four distinct experiments, and therefore the grand totals show the result of 32 comparisons. These experiments were conducted on both clay and sand, the results in both cases favoring drills. The size of each plat was two square rods.

SHALLOW VS. DEEP CULTURE

AND THE COMPARATIVE RESULTS OF DIFFERENT DEPTHS OF PLANTING.

BY G. MASSELINK AND W. C. BAGLEY (CLASS OF '95), 1892.

The objects of the experiment were (1), to test the relative merits of deep and shallow culture, and (2), to secure comparative results of the different depths of planting.

The plat on which the experiments were conducted is a sandy loam. The ground slopes gently towards the west, and presented for the experiment as nearly uniform conditions as could be obtained.

The planting was commenced June 11, and was completed June 14. Three varieties of potatoes were used, namely, Burbank's seedling, Lee's Favorite, and Thorburn, in order that the eccentricity of any particular variety might be guarded against as influencing the entire experiment.

The potatoes were planted at the depth of two, three, four, five and six inches. The cultivation was performed with a "Goodyear" cultivator, set at about one and one-half inches for the shallow culture, and at about five inches for the deep culture.

There was little difference in time of appearance between those planted two, three, four and five inches deep. In nearly all cases the three and four inch plants were a trifle more advanced than the two and five.

In ripening, little difference was noted between those planted six and five inches deep, either in point of advancement or in time of ripening. Those planted two and three inches deep were very slightly farther advanced than the others.

TABLE 3.—*Graphic illustration of yield per acre.*

(Scale: 60 bushels per ½ inch.)

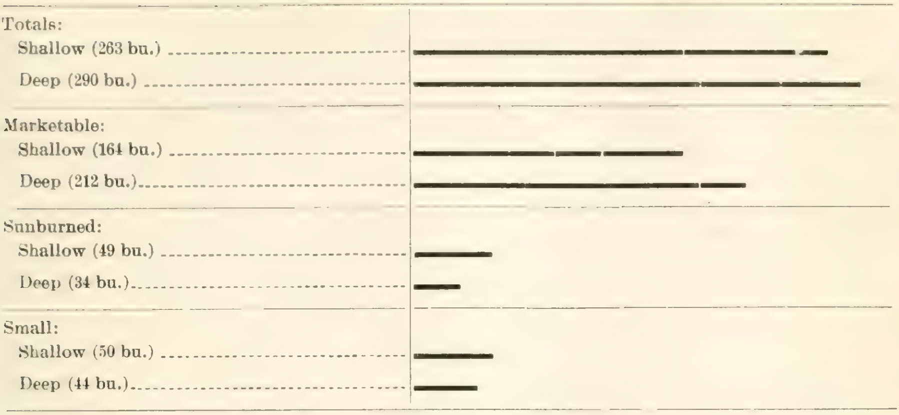


TABLE 4.—*Different depths of planting; graphic illustration of yield per acre.*

(Scale: 60 bushels per ½ inch.)

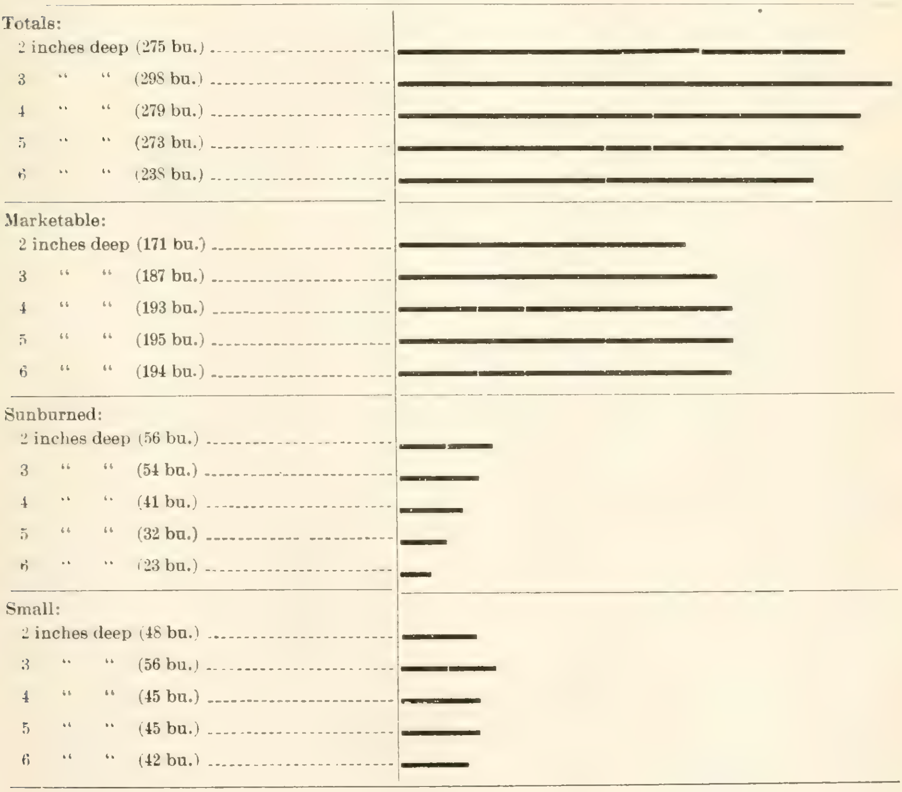


TABLE 5.—*Table of comparisons.*

Varieties.	Shallow culture.				Deep culture.			
	Totals.	Marketable.	Sunburned.	Small.	Totals.	Marketable.	Sunburned.	Small.
Burbank's seedling	1,386	930	293	163	1,529	1,189	188	152
Lee's Favorite	1,409	835	270	285	1,578	1,124	208	246
Thorburn	1,643	996	266	381	1,783	1,264	161	348
Totals	4,438	2,761	829	829	4,890	3,577	557	746

LEE'S FAVORITE.

TABLE 6.—*Comparative yields.*

	Shallow.				Deep.				Shallow.				Deep.				Shallow.				Deep.				Totals.	
Total	100				85				62				75				54				91				467	2 inches deep.
Marketable		41				67				23				37				23				56			247	
Sunburned			30				5				23				21				17				17		113	
Small				29				13				16				17				14				18	107	
Total	105				104				77				81				84				147				598	3 inches deep.
Marketable		46				78				40				48				48				93			353	
Sunburned			30				11				16				16				20				30		123	
Small				29				15				21				17				16				24	122	
Total	93				107				79				69				119				154				621	4 inches deep.
Marketable		60				83				47				47				63				112			412	
Sunburned			13				7				14				10				28				24		96	
Small				20				17				18				12				28				18	113	
Total	113				92				88				88				140				163				684	5 inches deep.
Marketable		75				71				56				63				95				122			482	
Sunburned			17				7				11				8				23				22		88	
Small				21				14				2				17				22				19	95	
Total	87				85				86				102				122				135				617	6 inches deep.
Marketable		66				67				62				80				90				100			465	
Sunburned			6				5				7				7				15				18		58	
Small				15				13				17				15				17				17	94	
Grand totals	498	288	96	114	473	366	35	72	392	228	71	74	415	275	62	78	519	319	103	97	690	483	111	96	5955	

BURBANK'S SEEDLING.

TABLE 7.—*Comparative yields.*

	Shallow.				Deep.				Shallow.				Deep.				Shallow.				Deep.				Totals.	
Total	130				112				112				125				119				110				708	2 inches deep.
Marketable		81				88				69				92				82				83			495	
Sunburned			35				15				23				22				29				10		134	
Small				14				9				20				11				8				17	79	
Total	127				94				98				117				86				113				635	3 inches deep.
Marketable		82				72				65				93				42				79			433	
Sunburned			32				11				20				16				27				20		126	
Small				13				11				13				8				17				14	76	
Total	125				93				80				110				69				105				582	4 inches deep.
Marketable		88				70				54				90				42				77			421	
Sunburned			24				12				17				13				18				16		100	
Small				13				11				9				7				9				12	61	
Total	111				111				64				100				43				74				503	5 inches deep.
Marketable		85				87				44				76				29				54			375	
Sunburned			15				17				10				8				8				11		69	
Small				11				7				10				16				6				9	59	
Total	102				106				92				95				28				64				487	6 inches deep.
Marketable		87				91				60				79				20				58			395	
Sunburned			8				7				22				7				5				3		52	
Small				7				8				10				9				3				3	40	
Grand totals	595	423	114	58	516	408	62	46	446	292	92	62	547	430	66	51	345	215	87	43	466	351	60	55	5832	

THORBURN.

TABLE 8.—*Comparative yields.*

	Shallow.				Deep.				Shallow.				Deep.				Shallow.				Deep.				Totals.	
Total	105				100				110				122				138				109				684	2 inches deep.
Marketable		66				80				55				75				66				72			414	
Sunburned			10				5				32				16				50				18		131	
Small				29				15				23				31				22				19	139	
Total	115				122				112				102				148				172				771	3 inches deep.
Marketable		78				86				56				80				79				96			475	
Sunburned			9				9				24				9				34				30		115	
Small				28				27				32				13				35				46	181	
Total	95				102				86				107				151				138				679	4 inches deep.
Marketable		79			9	5				47				83				98				99			465	
Sunburned			4				10				16				8				25				21		84	
Small				12				33				23				16				28				18	130	
Total	84				109				89				98				125				150				655	5 inches deep.
Marketable		57				68				45				80				88				123			461	
Sunburned			6				10				17				3				14				1		51	
Small				21				31				27				15				23				16	133	
Total	62				100				111				99				112				153				637	6 inches deep.
Marketable		36				59				59				87				87				117			445	
Sunburned			6				9				15				3				4				9		46	
Small				20				32				37				9				21				27	146	
Grand totals	461	316	35	110	533	352	43	138	508	262	104	142	528	405	39	84	674	418	127	129	722	507	79	126	6830	

From the preceding tables it will be seen that out of 45 experiments, the total yield in 29 cases was greatest with the deep culture, and in 13 cases was in favor of shallow culture, while in 3 instances the yield was practically the same.

In the same experiments the yield of marketable potatoes was in 40 cases in favor of deep culture, while four cases showed a balance in favor of shallow culture. The amount of sunburned potatoes was in 36 cases greatest in shallow culture, in 6 cases in favor of deep culture, while in three instances the yield was the same. The amount of small potatoes was in 28 cases greatest with shallow culture, in 15 cases greatest with deep culture, while 2 instances were indecisive.

The above figures show that deep culture gives the best result both as to total yield, and as to percentage of marketable to unmarketable. This holds true for all the different kinds of soil on the plat.

In the same tables, it will be found that the potatoes planted 3 inches deep gave the largest yield, and that those planted 5 inches deep gave the largest amount of marketable potatoes. The potatoes planted 2 inches deep gave the smallest amount of marketable potatoes.

MULCHING VS. CULTIVATION.

BY E. M. McELROY (Class of '93), 1891.

The object of this experiment was to show the yield of potatoes grown under a mulch, as compared with mulching in the hill, and also with the ordinary method of cultivation.

The potatoes were planted 33 inches apart each way. The plat was $2\frac{1}{3}$ rods wide and 16 rods long. This was divided lengthwise into 3 divisions, and crosswise into 8 plats, thus making 48 hills in each plat. Different amounts of seeds were used in the different plats, which accounts for the difference in the totals. But the same amount of seed was used for each division in any one plat. All the plats were planted with Burbank's Seedling on June 12 and all the potatoes were planted at a depth of 3 inches.

There was no difference in time of appearance between the unmulched potatoes and those covered with a mulch, while the potatoes planted with straw in the hill did not make their appearance until two days later.

The quality of the potatoes grown under the mulch was excellent. They were almost entirely free from scab. The unmulched potatoes were badly affected with scab, and although the yield was the heaviest, the quality was inferior. On the division where the straw was placed in the hill, the quality was poor and nearly every potato was affected with scab.

In comparing the results obtained, we must take into account the different amounts of work put upon different divisions. If the straw is taken from an exposed stack and is free from seed there is no work upon a mulched plat except planting, mulching and digging.

The conclusions drawn from this experiment, taking into consideration the cost of production and the quality of the yield, is that a person would be repaid in covering his potatoes with straw, especially if the season is dry.

TABLE 9.—*Comparative yields.*

	Total of Div.	Div. A. Mulched.	Div. B. Un-mulched.	Div. C. Mulched in hill.
Plat 4.				
Pounds marketable	274	86	95	93
" unmarketable	41½	10	12½	19
Plat 3.				
Pounds marketable	257½	80½	90¼	86¾
" unmarketable	50¾	19¾	17½	13½
Plat 2.				
Pounds marketable	252½	72	94½	86
" unmarketable	27¼	8¾	9	9½
Plat 1.				
Pounds marketable	128½	35¾	50	42¾
" unmarketable	8¼	2¾	2¾	2¾
Plat 4.				
Pounds marketable	273¾	86	97¾	90
" unmarketable	46	13	15	18
Plat 3.				
Pounds marketable	258½	74	95½	89
" unmarketable	40	11½	20½	8
Plat 2.				
Pounds marketable	228½	53	91½	84
" unmarketable	34	5	12½	16½
Plat 1.				
Pounds marketable	106½	21½	43	42
" unmarketable	20	10½	5½	4
Total of pounds marketable		508¾	657½	613½
" " " unmarketable		81¼	95¼	91¼
Per cent marketable		84¼%	87½%	89%
Bushels per acre		112.9	168.3	155.2

EXPERIMENT CONDUCTED BY D. D. McARTHUR (Class of '94), 1892.

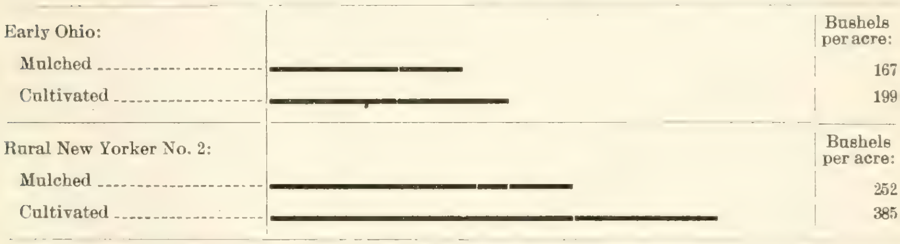
The object of this experiment was to ascertain which is the more profitable method of raising potatoes, by mulching or by cultivation. The soil was a light sandy loam, and was put in good condition preparatory to planting. The potatoes were quartered and were planted two pieces in a hill, at a depth of about four inches, the hills being thirty-three inches apart each way. Two varieties were used, the Early Ohio and the Rural New Yorker No. 2.

Plats A and B, each containing seven rows sixteen rods long, were planted with Rural New Yorker No. 2. Amount of seed used 160 lbs., or at the rate of 13⅓ bushels per acre.

Plats C and D were planted with Early Ohio, each plat containing seven rows sixteen rods long. Amount of seed used was 116 lbs., or at the rate of 9⅔ bushels per acre.

On June 10, plats B and C were covered with oat straw to a depth of 6 to 8 inches. This straw, however, was not free from grain, and oats came up thickly on 75 per cent of the plats. Unfortunately for the experiment, this did much to prevent the proper development of the vines, and this fact should be kept in mind while comparing the results given below.

TABLE 10.—*Comparative yields.*



EARLY OHIO.

TABLE 11.—*Table of profits.*

Mulched:	Dr.	Cr.
To plowing, harrowing seed and planting, $12.00; to 2 men and team 18¾ hours at 37½c, mulching, $7.03; to 1 man 5½ days at $1.25, digging, $6.87½	$25 90½	
By 132 bu. marketable potatoes at 50c. per bu.		$66 00
To balance	40 09½	
	$66 00	$66 00

Cultivated:	Dr.	Cr.
To plowing, harrowing seed and planting, $12.00; to man and horse cultivating 1½ days at $1.88, $2.82; to man and horse hilling ½ day, 94c.; to 1 man digging 3 3-10 days at $1.25, $4.13	$19 89	
By 148¼ bu. marketable potatoes at 50c. per bu.		$72 12
To balance	52 23	
	$72 12	$72 12

RURAL NEW YORKER NO. 2.

TABLE 12.—*Table of profits.*

Mulched:	Dr.	Cr.
To plowing, harrowing, seed and planting, $12.00; to 2 men and team 18¾ hours mulching at 37½c, $7.03; to 1 man 8 days digging at $1.25 per day, $10.00	$29 03	
By 215 bu. marketable at 50c		$107 50
To balance	78 47	
	$107 50	$107 50

Cultivated:	Dr.	Cr.
To plowing, harrowing, seed and planting, $12.00; to man and horse cultivating 1½ days at $1.88, $2.82; to man and horse hilling ½ day at $1.88, 94c; to man digging 6.4 days at $1.25, $8.00	$23 76	
By 223 bu. marketable at 50c		$111 50
To balance	87 74	
	$111 50	$111 50

During the summer of 1892 there was a large amount of rain; consequently, the cultivated plats did not suffer from drouth.

In a dry season it is very probable that the results would be changed quite materially in favor of mulching.

Mulching will probably never be practicable to a large extent, and when straw is scarce, not at all. The arguments in its favor are: 1st. In a dry season, the mulch, by retaining moisture would undoubtedly increase the yield of the crop; and 2d. By choking out the small weeds, and by keeping the ground moist, it does away with cultivation. Its objectionable features are: 1st. The increased amount of labor required to apply the mulch; and 2d. The increased amount of labor required to harvest the crop.

Caution. Be sure that the straw has been thoroughly exposed to the weather, in order that all the grain or seeds that it contains may be sprouted before applying it to the land, or the foul matter will grow and ruin the crop.

COMPARISON OF VARIETIES.

BY O. S. GRONER '94.

The object of this experiment was to test the comparative yields and the per cent of marketable potatoes of forty-nine varieties, each variety was planted on June 1, 1892, in rows 33 inches apart each way, and from 4 to 5 inches deep. The soil was a light sand. Two pieces were put in each hill, each piece containing two eyes, making four eyes in a hill. The potatoes were planted in plats one rod square, each plat containing thirty-six hills. The following tables give the yield in pounds of each plat, the percent of marketable potatoes and the computed yield per acre. A graphical illustration of the comparative yield of the various varieties is also given, on a scale of 60 pounds to the inch.

TABLE 13.—*Comparative yields.*

Varieties.	Pounds in plat.	Per cent of marketable potatoes.	Bushels per acre.
Alexander's Prolific	97	95½	258
American Giant	102	98	272
Brownell's Banner	87	93½	232
Burbank's Seedling	67½	95½	180
Beauty of Hebron	62	87	165
Bannock	91	95½	242
Crown Jewell	57	96	152
Chicago Market	82½	95	220
Chas. Downing	61	79 3-5	163
Clark No. 1	67	92½	179
Delaware	88	97½	238
Dakota	73	96½	195
Early Ohio	55¾	98	149
Early Mayflower	57	95½	152
Early Sunrise	52	38½	139

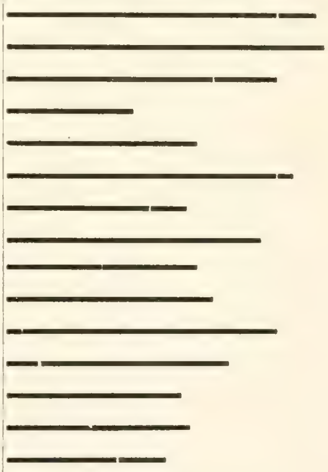
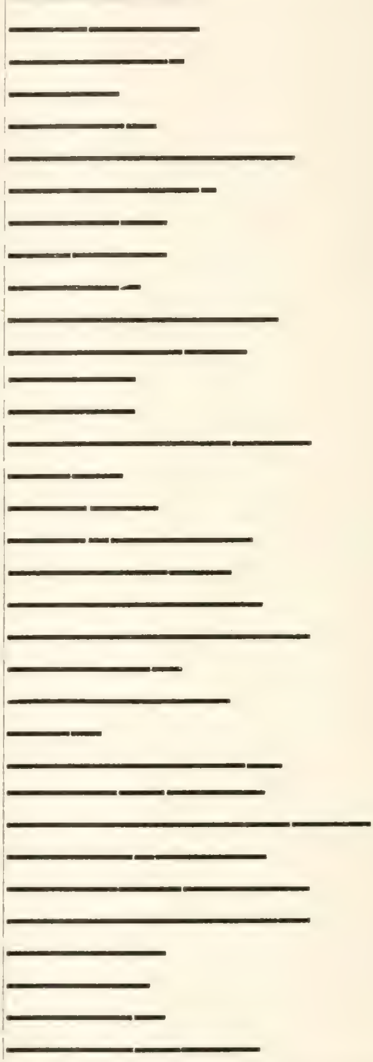


TABLE 13.—*Continued.*

Varieties.	Pounds in plat.	Per cent of marketable potatoes.	Bushels per acre.
Early Maine	64	89	171
Early Albino	62½	90	167
Early Telephone	60½	90	161
Extra Keeper	36	95	96
Empire State	51½	95	137
Garfield	97	93⅔	259
Green Mountain	69½	93	185
June Eating	54¾	90	146
Lee's Favorite	56	93	149
Monroe Seedling	44	90	117
Mammoth Pearl	83	90	228
New Badger State	73	93	195
New Queen	41	87½	109
Ohio Junior	42½	94	113
President Lincoln	98	89 3-5	261
Pearl of Savoy	36	90	96
Pringle's No. 5	49½	88½	131
Puritan	79½	94	212
Polaris	69	87	184
Putnam's Beauty	81	96	216
Peach Blow	96	94½	256
Queen of the Valley	54½	95½	145
Rural N. Yorker No. 2	69	94½	184
Rochester Favorite	31½	90	81
Red Star	88½	96½	236
Seneca Beauty	81	95½	216
Summit	114	95⅔	304
Superior	81½	....	217
Thorburn	96½	96	254
Thresher's Seedling	97½	96½	260
Vick's Extra Early	54	81⅓	144
White Star	48	89½	128
Watson's Seedling	52	90	138
White Elephant	84½	94½	225



In 1891, E. B. Hale (class of '93) conducted a similar experiment, testing 15 varieties, some of which were included in Mr. Groner's experiment the next season. The following table gives the result of his experiment. The graphical portion of the table is compiled on the same scale as that of the previous table, *i. e.*, 60 pounds to the inch.

TABLE 14.—*Comparative yields.*

Variety.	Yield of plat in pounds.	Per cent of marketable potatoes.	Bushels per acre.
White Star	73	94	195
White Elephant	73	97	195
Watson's Seedling	64½	90	172
Delaware	108½	94	289
Vick's Extra Early	61	70	162
Thorburn	60	75	160
Seneca Beauty	30	93	80
Rural New-Y'k'r No. 2	110	96	293
Rochester Favorite	90	94	240
Puritan	64	83	171
Polaris	51	82	136
Pearl of Savoy	60	83	160
New Badger State	86	96	229
Monroe Seedling	88	88	235
Mammoth Pearl	88	88	235
Red Star	76	90	202
Green Mountain	85^2	92	228
Garfield	83^2	90	223
Early Mayflower	61	90	162
Early Albino	57	84	152
Brownell's Banner	97	96	259
Early Telephone	58½	69	156
Early Maine	50	90	133
Empire State	47	91	125
Bannock	102	95	272
Chicago Market	71	94	189
Clark's No. 1	65	94	173
Burbank Seedling	87	91	232
Beauty of Hebron	60	91	160
American Giant	76	97	202
Alexander Prolific	96	94	256

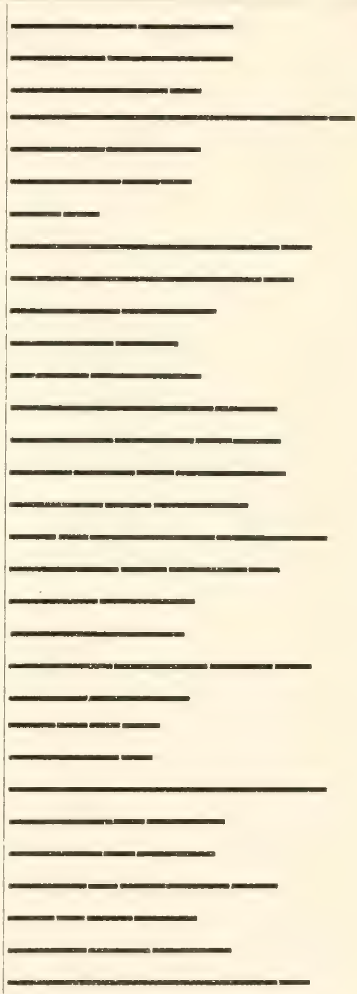
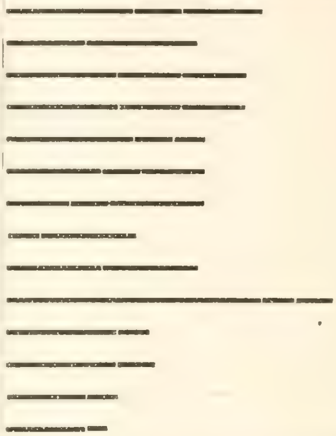


TABLE 14.—*Continued.*

Variety.	Yield of plat in pounds.	Per cent of marketable potatoes.	Bushels per acre.
Thresher's Seedling	82	92	219
Superior	62	90	165
Summit	67	94	179
Putman's Beauty	76	89	203
Crown Jewel	62	73	165
Queen of the Valley	58	91	155
Ohio Junior	57½	79	153
Early Sunrise	39	72	104
Pringle's No. 5	60	90	160
President Lincoln	105	92	280
Chas. Downing	46^2		124
June Eating	48	67	128
Extra Keeper	36	61	96
New Queen	33	73	88



It must be borne in mind that, although these experiments were carefully conducted and are indicative of certain facts, yet we are by no means justified in saying that certain varieties are far superior to others, although the experiments of the two seasons tend to prove it. A variety flourishing under other conditions of soil and climate might, and undoubtedly would, give far different results with different environments.

AGRICULTURAL COLLEGE, }
April, 1893. }

P. M. HARWOOD,
Agriculturalist.

HONEY ANALYSES.

No. 93—Zoölogical Department.

The subject of honey adulteration is one of great importance to bee keepers. It is generally believed that adulteration is very common. One of the leading chemists of the country has affirmed that probably one-half of the extracted honey in our markets is more or less adulterated. It has generally been thought by bee keepers, and with good reason, that if honey was so extensively adulterated it was the work almost exclusively of the dealers. In fact, in nearly all cases where analyses have shown honey to be adulterated, the specimens had the name of some prominent dealers upon them.

There are two very serious objections to this work of adulteration. In the first place it adds largely to the supply of presumable honey in the market, and so lessens the demand for the genuine article; and in the second place, the product is so inferior in quality that its sale must prove very deleterious to the honey market. In nearly all cases the adulterant used is the common starch or commercial glucose. This tasteless substance not only tends to lessen the peculiar honey flavor, but it leaves a metallic taste in the mouth, which is not only very disagreeable, but must in every case tend to destroy the appetite or desire for the genuine article.. It is hardly necessary to say that these statements only concern extracted honey, as comb honey is too delicate and fine an article for even the greatest human genius to counterfeit. It will be readily seen, however, that a taint on the fame of any honey is in some sense injurious to all.

There can be hardly any question that with good laws so great an evil could easily be prevented, were we surely able to detect it. This is the more true now, as the bee keepers are thoroughly organized and have formed the Bee Keepers' Union. This organization has the means and the inclination to fight and destroy any evil that confronts the welfare of bee keepers, providing that there is sure proof that the evil exists.

For the last few years there has been great doubt in the minds of many bee keepers whether even our best chemists could surely detect adulteration. The reasons for this were:

1. The report that honey of known purity had been analyzed and pronounced adulterated.

2 That honey is secured by the bees from such varied sources that it was possible that even our best scientists were today unable in all cases to distinguish it from the adulterated product.

3. It is well known that the nectar that the bees gather from the flowers is digested in the honey stomach of the bee as it is being conveyed to the hive, or possibly by being taken into the honey stomach of the young bees after it is delivered by the gatherers. We know that the

nectar is often largely cane sugar, while honey is largely reducing sugar, thus the nectar which the bees gather from the flowers is transformed before it becomes honey. There is hardly any doubt that the secretions from the large compound racemose glands in the head and thorax of bees furnishes the ferment which induces this change.

4. It seems more than likely that when bees gather honey very rapidly (they have been known to gather twenty pounds per colony in a day) that this reduction might be less complete, and so the honey would contain more cane sugar and less reducing sugar than would be found in honey which was produced more slowly. It was thought that this would account for the fact of the varying amounts of cane sugar in different specimens of honey. Again, we find the large glands, already referred to, in both the drones and the queen bees. This fact would argue that honey is not always reduced. and so the queen and drone bees would often have to digest the honey, or a portion of it. It is not at all likely that these bees would possess these glands if all honey was entirely destitute of this cane sugar.

I have the following from Dr. H. W. Wiley, our government chemist, regarding the composition of nectar:

"Referring to my statement in my former letter in regard to the composition of nectar, I think I am strictly correct.

Mr. Alex. S. Wilson, of the Glasgow University, published in the Chemical News, of August 23, 1878, a determination of total sugar in eight kinds of flowers giving also the proportion of fruit sugar. that is invert sugar or reducing sugar, and cane sugar estimated as fruit sugar. The proportions which he found are as follows:

Sugar in Flowers.

	Total. mg.	Fruit. mg.	Cane (as Fruit) mg.
1. Fuchsia, per flower	7.59	1.69	5.9
2. Claytonia alsinoides per flower	0.413	0.175	0.238
3. Everlasting pea, per flower	9.93	8.33	1.60
4. Vetch (Vicia cracca) per raceme	3.16	3.15	0.01
5. Ditto, per single flower	0.158	0.158	----------
6. Red clover, per head	7.93	5.95	1.98
7. Ditto, per floret	0.132	0.099	0.033
8. Monkshead, per flower	6.41	4.63	1.78

Of the eight flowers examined only two contained a larger proportion of cane sugar than of fruit. You see that my statement is absolutely borne out by these analyses.

A very extensive study of the composition of nectar was made by G. Bonnier and published in the Annales des Sciences Naturelles, Vol. 8, page 78. Bonnier also gives references to all preceding works on the composition of nectar. He cites very many I am not able to consult because they extend as far back as 1833.

Speaking of nectaries of plants, he says that in certain circumstances they emit a saccharine liquid called nectar and this liquid contains sugars of two kinds, viz., saccharoses and glucoses. Of the saccharoses which are found in the nectar the principal one is cane sugar. Rarely there is found mélézitose or mannitose. Of the glucoses the most common are dextrose and levulose forming invert sugar. In most cases M. Bonnier observes there is a little more dextrose than levulose.

Braconnot was one of the earlier authors who first pointed out that cane sugar existed in considerable quantities in the nectar of plants. In general, the nectar of plants is a solution of sugars, in which cane sugar, dextrose, levulose and a few other carbohydrates in small quantities are found. It is also more or less acid in its reaction: very acid in the case of some nectars like those of the Cicer, Lathyrus pratensis and almost neutral in the case of Vicia sativa.

The quantity of water which nectar contains in its natural state is very variable with different kinds of plants and also quite variable in the same kind of plants. In one sample of nectar there was found to be 95 per cent of water while others were found in which there was only a trace of water. The proportion of water usually varies from 60 to 85 per cent.

The total quantity of sugar also varies greatly. The quantity of cane sugar is very variable, according to Bonnier, in different kinds of plants. Its quantity also depends upon the age of the plant. In general the nectars which are extrafloral contain less cane sugar than the floral nectars. The nectars of the Prunus avium and Cratægus oxyacantha contain much less cane sugar than the nectar of the Vicia. The nectar of the Calluna vulgaris contains an extremely small quantity of cane sugar. Cane sugar, on the contrary, is extremely abundant in the nectar of the Mirabilis, Fuchsia and Helleborus niger. From some of these plants Bonnier was able to separate the cane sugar in a pure state by chrystallization. Some analyses of the nectars of different plants made by Bonnier follow below:

Nectar from Lonicera periclymenum.

Water	76.00%
Cane sugar	12.00%
Reducing sugar	9.00%
Dextrin, gums etc.	3.00%

Nectar from Lavandula vera.

Water	80.00%
Cane sugar	8.00%
Reducing sugar	7.50%
Dextrin etc.	4.50%

Nectar from Fritillaria imperialis.

Water	95.00%
Cane sugar	1.00%
Reducing sugar	1.50%
Dextrin etc.	2.50%

In regard to the analysis of honey, Bonnier says that good indications of the character of the nectar secreted by the flowers might be given by the analysis of honey provided the nectar did not suffer considerable modification in its passage through the organism of the bee; but in general, cane sugar, which is quite abundant in the nectar, exists only in very feeble quantities, or not at all, in the honey. He states, however, that in honey from mountainous regions a considerable quantity of cane sugar remains. (Possibly this honey was collected very rapidly, and so not fully digested by the bees. A. J. C.). Also honey harvested in different seasons presents very different characteristics, which often recall the character of the nectar which the bees gathered at the time. The quantity of saccharose in the nectar of the same species of flowers varies within wide limits. In the floral nectaries the maximum proportion of cane sugar in the tissues corresponds to the period when the ovary has reached its development and the fruit has not yet commenced to develop. In all kinds of nectaries, the cane sugar is accumulated as the flower approaches maturity and begins to be destroyed as the organs growing from the flower approach maturity. For this reason, when the amount of saccharose begins to diminish the relative proportion of reducing sugars increases.

It is not by any means certain, however, that at any time in the history of the plant, the sugars might exist in the flower wholly as cane sugar. On the other hand, it is well known that the juices of plants, in nearly all cases where they contain sugar, contain mixtures of various kinds of sugars.

Another reason, which makes plain the abundant appearance of cane sugar during the progress of the life of the plant, is that the cane sugar itself is not directly assimilable by the tissues of the plant, while the invert sugar is assimilable. The result would be that there would be a tendency of the plant to remove from its juices the invert sugar, while the cane sugar would be stored for subsequent employment.

I am aware of the fact that botanists often speak of nectar as sugar, giving the impression that it is cane sugar. Even Gray and Goodale speak of the specific gravity of nectar, and assume that the sugar contained therein is pure cane sugar.

5. It has long been admitted by European as well as American chemists that some honey, especially that from the pine honey dew, was so like

honey adulterated with glucose that it was difficult in the present state of the science to distinguish the one from the other. This is probably true of much of the honey that bees secure from the so called honey dew.

I have received the following regarding honey dew from Prof. H. W. Wiley:

> "In respect to the honey dew, I did not desire to express any opinion in regard to its origin. I have heard so many conflicting statements on this point that really I am at a loss to form a decision. My own impression is that the plant louse is the primary cause of the exudation, but whether the whole of the honey (would not nectar be a better term? A. J. C.) exuded passes through the organism of the louse or not is rather a doubtful problem. As you say, the character of the louse itself may have some effect upon the character of the honey produced, but all that the organism of the louse will probably produce on the honey would be in the shape of inversion just as it is inverted in the organism of the bee. It is not probable that the organism of the louse will produce a dextrinoid body from sucrose or invert sugar, although I do not undertake to say that such a change would be impossible."

Because of the above skepticism I commenced some years since to collect samples of honey secured from various kinds of nectar and produced in widely different localities, with the hope that by extended analyses we might arrive at certainty regarding our ability or inability to distinguish genuine from spurious honey. I thus secured honey from several different states, produced from nectar gathered from all the most valuable honey plants, as well as from various kinds of honey dew. Some of the honey was gathered very rapidly. Besides these samples, other samples of honey were adulterated with one-third or one-fourth glucose and still other was stored in clean empty combs, exclusively from pure granulated sugar syrup, and partly extracted the next day and partly after it was capped over. All of these samples were simply numbered and sent to Prof. H. W. Wiley of the Department of Agriculture, and most of them also to Dr. R. C. Kedzie of the Michigan Agricultural College and to Prof. M. A. Scovell, Director of the Experiment Station, Lexington, Kentucky.

In the following table will be found the kind of honey in each of these samples by number and such other data as are of interest in this investigation:

TABLE 1.

No.	Kind.	Locality.	Producer.	Remarks.
1	Basswood	Larrabee Pt., Vt.	J. H. Larrabee	Very fine honey and gathered very rapidly.
2	Sugar Syrup	Agr'l Coll., Mich.	J. H. Larrabee	18 lbs. stored in one night and extracted the next day. Like 29, this was indistinguishable by the taste from first-class honey.
3	Sour Gum	Florida	J. L. Clark.	
4	⅔ Basswood and ⅓ Glucose	Agr'l Coll., Mich.	A. J. Cook	I could readily detect the adulteration by the taste.
5	White Clover	Kentucky	A. C. Cunningham	This was fine honey, but not I think pure white clover.
6	¾ White Clover and ¼ Glucose	Agr'l Coll., Mich.	A. J. Cook	The adulteration was evident from the taste.
7	Unknown	Louisiana		This was of good flavor but never granulated.
8	Basswood	Larrabee Pt., Vt.	J. H. Larrabee	Very excellent and gathered very rapidly.
9	Golden-rod	Agr'l Coll., Mich.	A. J. Cook	Gathered rapidly.
*9	Honey Dew	Agr'l Coll., Mich.	A. J. Cook	Dark and of rank flavor.
10	Horsemint	Texas		Flavor very marked and not agreeable to me.

* No 9 in list of samples sent to Prof. W. A. Scoville.

TABLE I.—*Continued.*

No.	Kind.	Locality.	Producer.	Remarks.
11	Unknown	Louisiana		Rather dark but of pleasant flavor.
12	Oak Acorns	Missouri		From nectar which flowed from insect inhabited acorns. Honey rather pleasant.
13	Mesquite	Pt. Verd, Arizonia.	F. E. Jordan	Light colored with pleasant flavor.
14	Mellissa	Nebraska	H. C. Tyrell	Color light, flavor pleasant.
15	Rocky Mount'n bee-plant	Denver, Colorado	J. L. Peabody	Extracted the same day that it was gathered.
16	Black Mangrove	New Smyrna, Fla.	J. Y. Detwiler.	
17	Horsemint	Texas		Flavor peculiar and not agreeable to me.
18	Willow herb	Petoskey, Mich.	Mr. Case	Very fine in both flavor and appearance.
19	Poisonous (?)	North Carolina		Not poisonous to me.
20	Buckwheat	Agr'l Coll., Mich.	A. J. Cook.	
21	Heart's Ease	Iowa	S. D. Perkins.	
22	Heart's Ease(?)	Iowa		I think this was largely Golden rod.
23	Honey Dew	Agr'l Coll., Mich.	A. J. Cook	From bark lice, very dark and rank; unfit for market.
24	Alsike Clover	Agr'l Coll., Mich.	A. J. Cook	Flavor and appearance both very fine.
25	Heart's Ease	Farragut, Iowa	S. D. Perkins	Light colored with pleasant flavor.
26	White Clover	Middleton, Conn.	Chas. H. Lewis.	
27	Honey Dew	Agr'l Coll., Mich.	A. J. Cook	From Larch Aphides; light colored and pleasant.
28	Fruit Honey	Massachusets		Received from J. H. Larrabee.
29	Cane Syrup Honey	Agr'l Coll., Mich.	J. H. Larrabee	Like No. 2 this was from pure granulated sugar syrup, stored by the bees but not extracted till it was capped over.
30	Mixed Clover and Linden	Agr'l Coll., Mich.	A. J. Cook.	
31	Unknown	Jackson, Mich.		Received fram J. H. Larrabee.
32	White Sage	Filmore, Cal.	J. F. McIntire	Very white and pleasant in flavor.
33	Basswood	Platteville, Wis.	E. France	Said to have been gathered rapidly.
34	Huckleberry	Walton, Mich.	D. C. Leach	Produced on the pine plains.
35	Basswood	Larrabee Pt., Vt.	J H. Larrabee	Produced rapidly.
36	Red honey	Dubuque, Iowa	Mrs. Louisia Gertenbeck	I have seen such honey gathered from the juice of ripe red raspberries.
37	Mesquite'	Pt. Verd, Arizonia.	F. E. Jordan	Fine quality and said to have been gathered quite rapidly.
38	White Sage	Filmore, Cal.	J. F. McIntire	Produced rapidly.
39	Basswood (?)	Farmersville, Mo.	C. A. Spencer	I think too dark and mild for Basswood.
40	White Clover	Madison, Wis.	D. D. Anhien	
41	Basswood	Madison, Wis.	D. D. Anhien.	
42	Fall honey	Madison, Wis.	D. D, Anhien	Dark colored.
43	Lost in transit.			
44	Honey Dew (comb)	Dayton, Ill.	J. A. Green	Rank flavored; unfit for market,
45	Oak acorn	Missouri		Might have been partly from flowers.
46	Sage	California	Mr. Carey	Said to have been gathered rapidly.
47	Honey Dew	Hamilton, Ill.	Dadant & Son	One year old, dark and rank.
48	Honey Dew	Missouri	Dr. E. C. L. Larch.	Very rank and had been "scalded."
49	Honey Dew	Mt. Zion, Ill.	J. S. Hughes	Unfit for market, gathered in 1885.
50	Honey Dew	Illinois	Henry Wilson	Very rank; thought to have been gathered from hickory. Gathered in 1891.
51	Sumach	Norse, Texas	D. N. Clark	Lost in transit.
52	Honey Dew	Martinsville, Mo.	D. E. Keech	Very slow to crystalize, from hickory.
53	Honey Dew	Beaver, Penn.	Wm. L. Barclay	Gathered from oak. A. B. J., Vol. XXV. p. 67. Gathered in 1889.
54	Mixed	Beaver, Penn.	Wm. L. Barclay	Gathered in 1890.
55	Honey Dew	Martinsville, Mo.	D. E. Keech	This was excellent in flavor.
56	Honey Dew	Martinsville, Mo.	D. E. Keech	This was rank and dark.

These samples were all analyzed by the several chemists, and as we had reason to suppose would be the case, the results were surprisingly alike. All the chemists detected the adulteration, but could not distinguish honey dew honey from adulterated honey, nor could they detect honey produced by feeding syrup made from granulated sugar, but classed it with some of the best genuine honey, as suspicious. This product, as will be seen by the analyses, is not simply cane syrup, but transformed cane syrup which has been changed by the bees, much as they change nectar which they collect from the flowers, as they digest it or transform it into honey.

The following are the reports of these several analyses, with the comments of the several chemists who made them.

TABLE NO. 2.—*Report of analyses made by Prof. H. W. Wiley, of the department of agriculture, Washington, D. C.*

Number.	Serial number.	% Water.	% Ash.	Polarization 30°.	% Sugar by inversion.	% Invert sugar.	% Invert sugar in dry substance.	% Sugar in dry substance.	% Total sugar in dry substance.	Polarization at 88°.
1	10784	16.46	0.09	— 3.40	9.84	70.83	84.78	11.78	96.56	15.86
3	10785	19.73	0.08	— 0.60	9.34	65.31	81.36	11.64	93.00	18.54
3	10786	15.80	0.31	—12.30	1.30	70.31	83.50	1.54	85.04	11.53
4	10787	19.23	0.22	+38.30	2.70	60.02	74.31	3.34	77.65	52.83
5	10788	22.02	0.22	—17.10	0.54	67.55	86.62	0.69	87.31	4.63
6	10789	15.19	0.21	+39.70	4.84	65.85	77.65	5.70	83.35	53.53
7	10790	19.22	0.33	—20.00	1.53	69.41	85.92	1.89	87.81	3.81
8	10791	15.30	0.06	— 4.00	6.92	70.74	83.52	8.17	91.69	15.75
9	10792	18.68	0.39	—14.40	0.92	71.39	87.79	1.13	88.92	7.30
10	10793	20.17	0.23	+ 4.50	14.50	73.37	91.91	18.16	100.07	20.08
11	10794	19.15	0.30	— 7.10	2.23	72.04	89.10	2.76	91.84	11.33
12	10795	17.60	0.35	— 1.50	1.77	70.80	85.92	2.14	88.06	19.80
13	10796	18.90	0.15	—13.90	0.54	75.70	93.34	0.66	94.00	6.39
14	10797	17.20	0.19	—10.80	1.54	72.93	88.08	1.86	89.94	11.12
15	10798	18.07	0.58	—14.30	3.01	72.11	88.01	3.67	91.68	7.41
16	10799	22.75	0.35	—23.10	1.39	71.12	92.06	1.79	93.85	1.34
17	10800	15.85	0.20	—23.50	3.40	75.42	89.63	4.04	93.67	
18	10801	17.15	0.23	— 3.90	3.94	70.74	85.38	4.75	90.13	17.90
19	10802	19.29	0.37	— 5.90	2.55	67.51	83.65	3.15	86.80	14.30
20	10803	16.55	0.28	— 3.15	2.10	73.45	88.02	2.51	90.53	15.50
21	10804	20.07	0.26	—12.70	2.02	70.47	88.16	2.52	90.68	8.20
22	10805	19.59	0.15	—12.20	1.79	72.21	89.80	2.22	92.02	9.70
23	10806	13.76	0.62	+23.10	5.21	61.73	71.58	6.04	77.62	40.80
24	10807	15.70	0.10	— 8.50	3.42	72.80	86.36	4.05	90.41	13.70
25	10808	16.42	0.17	—14.50	1.40	75.56	90.40	1.67	92.07	9.10
26	10809	18.09	0.35	— 9.35	1.48	70.96	86.63	1.80	88.43	12.50
27	10810	15.51	0.12	—10.45	1.40	76.38	90.40	1.65	92.05	11.70
28	10811	18.17	0.20	— 2.50	3.89	69.87	85.38	4.75	90.13	17.20
29	10812	18.36	0.16	— 2.30	7.24	69.84	85.55	8.86	94.41	18.70
30	10813	17.08	0.42	—11.40	1.61	74.97	90.41	1.94	92.35	9.99
31	10814	18.10	0.08	—13.00	1.84	75.70	92.43	2.24	94.67	7.70
32	10815	16.88	0.36	—17.60	3.92	74.54	89.67	4.71	94.35	3.52
33	10816	18.65	0.28	— 8.20	1.46	74.77	91.91	1.79	93.70	12.67
34	11090	17.10	0.39	—17.50	1.40	77.18	93.10	1.68	94.78	3.81
35	11091	17.81	0.27	—10.30	2.84	74.12	90.18	3.45	93.63	10.80
36	11092	20.42	0.45	—12.30	3.40	68.82	86.48	4.27	90.75	8.85
37	11093	17.09	0.10	—15.40	1.45	77.80	93.85	1.76	95.61	6.69
38	11094	15.49	0.18	—14.30	3.48	73.64	87.14	4.11	91.25	8.44
39	11095	17.08	0.64	— 6.40	3.18	71.75	86.53	3.83	90.36	13.80
40	11099	17.88	0.14	—13.40	1.80	75.19	91.56	2.19	93.75	8.24
41	11100	21.57	0.58	—34.50	3.40	70.83	90.31	4.33	94.64	— 8.44
42	11101	22.48	0.61	— 4.40	1.78	67.34	86.87	2.29	89.16	16.20
43										
44	11134	18.84	0.59	+ 2.60*	2.96	62.74	77.30	3.64	80.94	
45	11135	14.44	0.16	—16.60	3.19	75.63	88.45	3.73	92.18	
46	11136	16.42	0.18	—18.60	0.87	73.56	88.01	1.04	89.05	
47	11137	19.13	0.79	+ 3.60	2.96	66.07	81.70	3.66	85.36	
48	11133	18.40	0.53	— 4.30	1.44	67.58	82.82	1.76	84.58	
49	11139	17.76	0.46	+ 4.50	1.52	63.86	77.65	1.84	79.49	
50	11138	18.52	0.78	+ 4.40	3.65	62.14	76.27	4.47	80.74	
51										
52										
53	11140	21.94	0.36	—13.50	0.30	66.43	85.10	0.38	85.48	
54	11141	19.10	0.15	—11.70	1.14	71.26	88.08	1.41	89.49	
55	11153	17.59	1.12	— 3.90	2.27	66.42	80.60	2.75	83.35	
56	11154	20.97	0.44	+10.10	5.24	62.46	79.03	6.63	85.66	

* All in this column below the asterisk were read at 22° instead of 30°.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF CHEMISTRY,
Washington, D. C., December 23, 1892.

PROFESSOR A. J. COOK:

DEAR SIR—I beg to enclose you a sheet giving the results of our analyses of the samples of honey received from you. Somehow or other, you have omitted numbers 43, 51 and 52. The others are numbered as you sent them, and such information as has been received in regard to them will be found on the sheet.

The more careful examination confirms the preliminary results which I sent you in my letter of the 21st of July last. There are some additional points to which I wish to call your attention.

Prof. Scovell, in looking over my analyses, called my attention to the fact that my No. 9 must be wrong, as it differed so from his No. 9. (It is interesting to note that this was a sample of honey dew honey.—A. J. C.) I then repeated the work with No. 9 and found that it was exactly correct. He therefore suggested that his number and mine were different samples, and at my request he sent me a sample of his No. 9, which as you see is entirely different from mine. The No. 9 of Prof. Scovell polarized at 30° + 12.0; at 88° + 29.85; on inversion at 30° it polarized + 5.5. You will see, therefore, that it is entirely different from the sample entered as my No. 9, and is evidently one of the adulterated honeys, having either received treatment with glucose or else being the product of the aphis from the pine tree. (From plant or scale lice not necessarily from pine tree aphis, or even aphides—A. J. C.)

I desire to call your attention further to the samples of honey which at ordinary temperatures show a plus polarization, and which do not have any notable percentage of sucrose. These samples are Nos. 44, 47, 49, 50 and 56. Fifty-six, however, has quite a notable proportion of sucrose. These are samples which show uniformly a low proportion of invert sugar, away below the normal, but are not strongly enough right-handed to indicate that they are mixed with glucose. I am inclined to think that these give us an excellent clue for the detection of the aphis honey when taken especially from the pine trees. (It would be better to omit the words "pine tree" altogether, and say simply honey dew, as most of this honey dew could not have come from pine tree aphides, as there were few or no pines in the regions.—A. J. C.)

I beg to call your attention further to this, that these honeys have uniformly a high content of ash. Added to them is No. 55, which, although it polarizes to the left, has an abnormally low percentage of invert sugar and an abnormally high percentage of ash. I have not yet gotten data enough to make a positive assertion, but I believe that a honey which polarizes to the right at ordinary temperatures, or even slightly to the left, and which has an abnormally low percentage of invert sugar and abnormally high percentage of ash, may be spotted at once as an aphis honey. This I make, of course, guardedly and subject to subsequent correction, but you will see on studying the data, how my results are borne out. For this reason I should be inclined to class the honey No. 23 as a honey dew honey, because of its right-handed polarization (not very great), its high percentage of ash and its abnormally low percentage of invert sugar. Honeys Nos. 4 and 6 both have right-handed polarizations, abnormally low percentages of invert sugar, but the ash is not much above the normal. These, therefore, would be excluded from the honey dew honeys. I admit that there are other honeys in the list which have a high percentage of ash, viz., No. 39 (this was sent me from Mo. as basswood honey. I questioned the fact, from the taste and appearance of the sample, as will be seen by the table. If it were basswood, it was not unmixed.—A. J. C.), which has so high a percentage as to be suspicious. No. 36 (red honey probably from juice of ripe red raspberries.—A. J. C.), likewise with so high a percentage of ash as to be suspicious. But these honeys are strongly left-handed, and therefore could not be positively condemned.

I have added a column of polarizations at 88° temperature for this reason: Invert sugar at that temperature is optically inactive and has no influence on the ray of polarized light. Any polarization, therefore, which a body may have at that temperature, must be due either to sucrose or other optically active bodies. If now we subtract from the polarization of 88° the percentage of sucrose, what is left will indicate the presence of dextrose and other right-handed bodies. In this way it is seen that all suspicious honeys which we examined in this way have an abnormally high right-handed polarization at 88°. This can also be taken as additional evidence of adulteration.

It appears to me that we are well on the road to being able to distingush louse honey from true floral honey, as we are certainly able to distinguish glucose honey from both.

In regard to the percentage of water permit me to say that our determinations were made on one or two grams of the substance in a flat platinum dish, drying from 15 to 20 hours at the temperature of boiling water. There is no more difficult thing than to determine accurately the percentage of water in honey, and while I do not claim that our numbers are absolutely c rrect yet they are as exact as we could well get them.

The determination of the invert sugar was also made as such by the reduction of the copper, subsequent solution and precipitation of the copper by an electric current, in the metallic state, and calculating the results as invert sugar. The factors having been determined by working on pure cane sugar inverted, as a standard, our results must be practically correct. Other methods of estimating the invert sugar and calculating it as dextrose, or estimating it volumetrically, would lead to different numbers and this must be taken into consideration in looking over these figures.

I had a much more elaborate work planned out for this investigation, but knowing that you are anxious to get these results I transmit them. Hoping that they will be satisfactory to you, I am,

Respectfully,
H. W. WILEY, *Chemist.*

I desire to call your further attention to two samples which still show a left-handed polarization at 88°. These are Nos. 16 (Black mangrove honey.—A. J. C.) and 41.

It is evident from this behavior that these honeys contain an axcess of levulose; that is, they contain more levulose than would naturally be present in invert sugar.

Sample No. 41 (Basswood honey from Wisconsin.—A. J. C.) has most remarkable qualities. Its still high left-handed polarization at 88° 8.44 indicates that it is something which is very peculiar. If it pure honey which has been gathered from nectar, it contains an abnormal percentage of levulose. It might be an ordinary honey which was adulterated with a solution of levulose, if such an adulteration is ever practiced. This honey could be made also in another way, that is, by draining granulated honey in which the dextrose part of the invert sugar remains in a solid state and the levulose part runs off. This would be similar to the method of making open-kettle molasses in the south, in which the crystalized sugar is placed in hogsheads with perforated bottoms and the molasses allowed to drain out. Sample No. 41 has evidently been made in one of the ways mentioned above. *At any rate it is an abnormal honey,* (italics mine. A. J. C.) and I should be glad to know its history when convenient.

In regard to sample No. 16 the same remarks may be applied except with less accentuation.

H. W. W.

KENTUCKY AGRICULTURAL EXPERIMENT STATION,
M. A. SCOVELL, DIRECTOR,
Lexington, Ky., Aug. 6, 1892.

PROF. A. J. COOK, AGRICULTURAL COLLEGE, MICHIGAN:

MY DEAR SIR—I send you enclosed with this letter a tabulated statement of results of the analyses of your honeys, together with some that I had collected and analyzed. These last for the purpose of comparison.

Nos. 1-39 inclusive are your honeys. The numbers are the same as given by you. No. 40 is orange flower honey from Florida. By special request this honey was collected and centrifugaled in the presence of an owner of an orange grove in Florida, who vouches for its purity.

No. 41 I obtained from a can of honey sent to one of the boys here by his mother. The honey was taken from an old hive and was old comb in which the honey had granulated somewhat.

No. 42 is a honey which I took myself from a cap in a hive a few days before the analysis was made. The cap was nearly full, the outer combs only remaining uncapped.

Nos. 43-50 inclusive were honeys gathered around Lexington, although not in my presence, but I have every reason to believe that they were genuine. I made analysis of them last year for Dr. Wiley.

No. 51 is a mixture of 90 per cent of the honey No. 42, and 10 per cent cane sugar.

Explanations: The cane sugar was calculated by the usual formula from the direct and indirect readings of the polariscope. The reducing sugars by Fehling's solution; water from less after heating from a lower and then at a temperature of 103° C. for an hour; ash by ignition of the water free residue.

In order to ascertain whether any of the honeys had been mixed with glucose and invert sugar in such proportions that the direct and indirect polarization would indicate a pure honey, 13.024 grams of each honey were diluted with 40 c. c. of water, and dialyzed for 24 hours. This dialyzed residue was then polarized. The readings in the column are given in terms of the normal solution (24.048 grams honey diluted to 100 c. c.) By request Prof. Garman examined the honeys for pollen. His results are given in the column headed pollen. The last honeys you sent came during his absence.

Comments: From the results obtained I am of the opinion that honeys Nos. 4 and 6 are adulterated with glucose. I reach this conclusion from the fact: First, that they are strongly right-handed honeys; second, that there is a large amount of undetermined matter in them; third, that after dialysis the residue still polarizes strongly to the right. The ash also is in excess of what it generally is in pure honeys.

Honeys 9 (honey dew honey.—A. J. C.) and 12 (honey dew honey.—A. J. C.), and 1 (most excellent basswood honey.—A. J. C.) and 2 (sugar syrup honey.—A. J. C.) are difficult to classify. Nos. 9 and 12 might be adulterated with a small quantity of glucose or they might be natural honeys of the "pine tree order." *The ash of each appear to be abnormally large.*

The indications are that honey Nos. 1 and 2 have either been adulterated with about ten per cent of cane sugar or the bees have been fed cane sugar. *With our present knowledge* (italics mine—A. J. C.), however, I would not positively state that they were sophisticated honeys. That a genuine honey might be adulterated with ten per cent of cane sugar and have the composition of honeys Nos. 1 and 2 may be readily seen by reference to the adulterated honey No. 51.

Honeys Nos. 5, 17, 34 and 37 (all genuine honey.—A. J. C.), polarize more than ordinarily to the left, but if invert sugar has been added to any of the honeys I have been unable to detect it.

Honey No. 3 was fermenting when received and some of it had leaked out. Honeys Nos. 34 and 39 were received in bad condition. The combs were nearly drained when they were unpacked.

I hope these results may be of interest to you and throw light upon this most important question. If you have any more honeys to send I will be glad to investigate them. I hope the work may be continued until the problem is solved.

Yours very truly,
M. A. SCOVELL.

TABLE NO. 3—*Results analyses of honey, made by Prof. M. S. Scovell.*

FROM PROF. A. J. COOK.

Number.	Polarization.		Temp. Indirect.	Sucrose.	Reducing Sugars.	Water.	Ash.	Not Determined.	Dialyzed residue pol'rized.	Pollen.
	Direct.	Indirect.								
1	—5.3	—16.3	25	8.35	69.56	13.91	0.09	8.09	1.6	frequent.
2	—1.1	—11.9	25	8.21	66.67	17.65	0.07	7.40	2.0	none.
3	—14 1	—17.25	25	2.43	72.72	13.68	0.19	10.98	3.4	rare.
4	37.6	34.65	25	2.24	62.01	17.08	0.22	18.45	34.5	none.
5	—19.1	—21.45	25	1.78	68.37	19.30	0.16	10.39	0.0	none.
6	38.8	34.0	25	3.65	68.37	12.08	0.23	15.67	34.8	rare.
9	11.9	5.5	25	4.86	65.57	13.33	0.93	15.31	13.2	frequent.
12	—3.5	—6.0	25	1.90	71.43	13.09	0.54	13.04	5.0	frequent.
17	—25.8	—30.0	25	3.19	75.47	12.83	0.17	8.34	—2 0?	none.
21	—5.7	—9.45	25.8	2.86	75.47	15.82	0.16	5.69	2.8	rare.
22	—13.6	—15.95	25	1.78	76.92	15.93	0.14	5.23	—2.0?	none.
24	—1.6	—4.95	25	2.54	76.20	12.50	0.05	8.71	3.8	frequent.
25	—15.8	—18.35	25	1.93	75.47	11.81	0.10	10.69	1.8	present.
26	—2.5	—4.4	25.2	1.44	75.47	13.64	0.19	9.26	1.4	present.
29	—6.0	—11.75	25.2	4.00	73.39	16.80	0.13	5.68	0.7	frequent.
30	—12.8	—15.95	25	2.39	76.19	13.69	0.31	7.42	1.1	frequent.
33	—9.6	—11.9	25.2	1.71	75.47	15.83	0.28	6.71	1.3	present.
34	—20.0	—20.9	25.4	0.68	78.43	16.52	0.23	4.14	—1.6	
37	—17.0	—19.45	24	1.89	80.00	15.52	0.06	2.53	0.3	
39	—9.6	—14.6	23.8	3.78	75.47	15.26	0.36	5.13	0.2	
40	—15.1	—21.0	24	4.46	74.76	16.57	0.09	4.12	----------	
41	—14.4	—17.6	25.2	2.43	72.97	17.72	0.40	7.38	----------	frequent.
42	—14.3	—17.25	24.8	2.24	75.47	18.33	0.11	3.85	----------	none.
43	—16.8	—18.4	24.2	1.23	75.47	14.31	0.06	8.93	----------	
44	—13.2	—16.4	25.2	2.46	74.76	15.77	0.03	6.98	----------	
45	—11.0	—14.4	24.8	2.62	65.57	22.57	0.04	9.20	----------	
46	—13.2	—16.4	24 2	2.45	72.73	14.28	0.02	8.52	----------	
47	—10.4	—15.0	24.8	3.54	74.08	14.65	0.02	7.71	----------	
48	—14.2	—16.9	24.4	2.07	73.39	16.86	0.02	7.66	----------	
49	—10.4	—14.6	24	3.22	72.73	14.30	0.03	9.72	----------	
50	—11 2	—16.4	24	3.99	73.39	14.15	0.01	8.46	----------	
51	—7.7	—16.9	25	7.00	67.79	----------	----------	----------	----------	

The following are the results of the analyses made by Dr. R. C. Kedzie at the College:

ANALYSIS OF HONEYS.

By direction of the State Board of Agriculture a collection of honeys—pure and adulterated—furnished by the zoölogical department, were analyzed to test the question whether chemical analysis can distinguish between genuine and adulterated honeys. The same honeys were sent to Prof. H. W. Wiley, chemist of the department of agriculture, and Prof. M. A. Scovell, of the Kentucky experiment station. The results of these three parallel analyses were compared in Washington, and the adulterated honeys were detected in every genuine honey (*i. e.*, material made from the nectar of flowers), and doubt was entertained only in abnormal honeys, *e. g.*, honey made from the secretions of plant lice.

The following table shows the results of analysis of all the samples furnished, a few numbers being blank because the specimen was not furnished:

TABLE NO. 4.—*Analyses of honeys from Prof. A. J. Cook.*

Number.	Poplarization.		Temperature (centigrade.)	Sucrose, per ct.	Reducing sugar, per ct.	Water, per ct.	Undetermined, per ct.	Remarks.
	Direct.	Indirect.						
1	—6.16	—13.2	20°	5.32	69.	14.68	11.0	
2	1.76	—12.3	20°	7.95	75.	14.90	2.15	
3	—11.4	—13.2	20°	1.36	68.6	15.25	14.79	
4	36.4	32.8	20°	1.20	58.3	18.8	21.70	Precipitate of dextrine.
5	—14.5	—20.2	20°	4.30	68.3	21.2	6.20	
6	38.7	35.6	20°	2.34	58.0	15.20	24.46	Precipitate of dextrine.
7	—18.9	—26.4	20°	5.66	68.9	18.1	7.34	
8	—5.72	—14.9	20°	6.94	70.7	15.1	7.26	
9	.0	—5.	20°	.37	67.3	14.9	7.34	
10	—1.76	—4.4	20°	1.99	71.9	19.6	6.51	
11	—7.9	—22.8	20°	11.20	73.6	14.70	.50	
12	—4.4	—7.4	20°	2.26	71.8	15.9	10.04	
13	—14.9	—15.4	20°	.37	75.3	18.2	6.13	
14	—8.8	—11.8	20°	2.26	73.5	12.83	11.41	
15	—18.9	—22.6	20°	2.79	73.1	15.08	9.03	
16	—17.6	—18.4	20°	.60	70.6	18.52	10.28	
17	—24.2	—27.2	20°	2.26	77.6	14.8	5.32	
18	—3.08	—6.80	20°	2.80	69.7	13.44	14.06	
19	—5.7	—9.2	20°	2.64	67.7	14.49	15.19	
20	—18.4	—19.3	20°	.68	70.5	12.90	15.92	
21	—7.04	—10.5	20°	2.64	75.1	17.60	4.66	
22	—10.5	—15.4	20°	3.70	71.7	18.3	6.30	
23	22.	13.2	20°	6.64	58.2	13 4	21.76	Precipitate of dextrine.
24	—9.2	—15.4	20°	4.68	76.8	13.3	5.22	
25	—13.2	—19.7	20°	4.91	74.1	14.9	6.09	
26	—16.2	—18.4	20°	1.66	75.6	19.1	3.64	
27	—10.1	—13.2	20°	2.34	80.1	15.4	2.16	
28	—1.32	—8.8	20°	5.64	67.8	15.6	10.96	
29	—1.76	—11.0	20°	6.22	60.2	17.3	16.28	
30	—11.	—14.08	20°	3.77	78.2	15.8	2.23	
31	—11.8	—15.4	20°	2.71	68.1	16.5	12.69	
32	—15.7	—23.7	20°	6.79	68.8	16.1	8.31	
33	—7.4	—11.	20°	2.71	75.1	18.6	3.59	
34	—18.4	—23.3	20°	3.70	78.5	12.10	5.70	
35	....	....	20	....	....	....	....	
36	....	....	20°	....	....	....	....	
37	—15.4	—17.6	20°	1.66	75.2	16.6	6.54	
38	—13.2	—22.	20°	6.64	60.5	15.9	16.96	
39	—6.6	—11.0	20°	3.32	68.8	17.6	10.28	
40	....	....	....	....	....	....	....	
41	....	....	....	....	....	....	....	
42	....	....	....	....	....	....	....	
43	—11.0	—13.2	20°	1.66	75.0	15.3	8.04	
44	....	....	....	....	....	....	....	

R. C. KEDZIE, *Chemist.*

CONCLUSIONS.

These analyses show conclusively that our chemists can easily distinguish honey adulterated with glucose, the only adulterant that is likely to be used, from all honey except that produced from honey dew. All three chemist at once detected the two samples which were adulterated, the one with one-fourth, the other with one-third of the common commercial glucose of the shops. These sampies gave a right-handed rotation, and a precipitate of dextrine. The samples were numbers 4 and 6.

It is also shown that previous to this time our best chemists could not distinguish between adulterated honey and some kinds of honey dew honey. Thus Prof. Wiley and Dr. Kedzie grouped No. 23 with Nos. 4 and 6 as adulterated, and Prof. Scovell did the same with No. 9 in his list. It is to be hoped that the careful analyses of Prof. H. W. Wiley have given us a means of separating the rank honey dew honey from the adulterated article. Although this is not a matter of great practical importance, for such honey will never be placed on the markets, in competition with other honey, yet it is very desirable that the chemist shall be able to distinguish all adulteration. If a large percentage of ash, and a relatively small proportion of invert sugar, together with a right-handed or slight left-hand rotation is a sure indication of honey dew honey, then surely that fact alone is worth many times the expense and trouble which these investigations have cost. These analyses also clearly show that the term pine tree honey is a misnomer, and that the term honey dew honey should be used in its stead, for honey produced from secretions of aphides, as the honey dew in question was from other aphides than those attacking the pine.

Another interesting fact appears in the analyses of Nos. 12, 45, 27 and 55. All of these were from honey dew. All were pleasant to the taste, and all but one, at most, would pass as genuine honey. They all gave a right-handed rotation, a large amount of invert sugar, and a small amount of ash. They would all be pronounced genuine honey by the chemists and by the consumer. Will not Prof. Wiley then have to modify his definition of honey? Is it necessarily transformed nectar from flowers? Is it not more in harmony with truth to call it transformed nectar, and confess that there may be grades of honey which we all know to be true. Because the cow has eaten leeks, shall we say that the product of the churn is not butter? Let us tell the truth, and shame the timid soul, by taking what I believe is the only defensible ground, that any liquid product of bees is honey; that some honey of excellent quality was not produced from the nectar of flowers, and that the quality will vary with the source of the nectar. Nectar must pass into the honey stomach of the worker bees, and then be returned to the honey cells to produce honey and this is honey whatever the source of the nectar. Any other definition clearly makes it impossible to guarantee any honey as genuine. These analyses make this clear, as Nos. 12, 27 and 45 were entirely unsuspected by the chemists, and yet each had its chief source in honey dew.

This is further emphasized in what Prof. Wiley says on page 10 regarding No. 41. This was basswood honey from Wisconsin, of most excellent quality, yet he pronounces it abnormal. Probably it was slightly mixed with other honey. There are points in which chemists who are not physiologists or apiarists are likely to err. They do not take into account the completeness of digestion. Thus numbers 2 and 29 were both pure sugar syrup honey, and yet so different that the chemist would not suppose them of like origin. One was extracted at once while the other was permitted to remain in the hive till it was capped over. It was more fully transformed. It is quite possible that the same honey gathered rapidly would give more cane sugar. If so and a chemist should analyze such a sample from a mountain region, he would decide that mountain honey was rich in cane sugar or sucrose. From the fact of admixture, the varied sources of honey and different degrees of digestion, either from being rapidly stored or from being extracted before it was fully ripened, we see we shall not know the full truth till many samples of known origin are analyzed.

It is also interesting that Prof. Wiley grouped Nos. 1, 2, 8, 10 and 27 together because of the abnormal quantities of sucrose. He says of them: "They would be passed by me as pure, because we are not certain but that in some circumstances bees may not gather honey with this abnormal proportion." He adds further: "No. 10," which was genuine horse mint honey, "seems to be the worst one of the lot, having 14.5 per cent of sucrose. Nos. 1 and 2," genuine basswood and sugar syrup honey, respectively, the latter extracted the day after it was stored, "have nearly ten per cent of sucrose. Nos. 8 and 29," genuine basswood and sugar syrup honey respectively, the latter the same as No. 2, only capped over, "a little over 5 per cent, while normal honeys have usually from .5 to 3 per cent of sucrose only." It is very interesting to observe that the amount of sucrose, or sugar by inversion, in number 29 was only 5 per cent, while that of number 2 was 10 per cent. This shows that digestion or tranformation is not complete when the honey is first stored, but goes on either in the cell or through the young bees taking it again into the stomach, as Mr. Doolittle believes they do, that it may be more thoroughly digested, and then depositing it again in the cells. We see, then, that as yet the chemists cannot distinguish honey from flowers from granulated sugar syrup honey. Prof. Wiley wrote me under date of September 14: "It is true that with our present knowledge of honey chemistry the difference cannot be detected." I will add that as yet I have not found a person that could distinguish the difference by taste, though several experts, including myself, were among the number.

I am certain that no person could distinguish the sugar syrup honey from the genuine, though many think they could do so. It is quite possible that sugar syrup stored out of season might not be so digested or transformed, and the product would not be so very much like the best of honey. Possibly flower nectar honey produced out of season would not be so excellent as we usually find it. Further investigation is required to settle this question.

These investigations, then, prove that as yet our best chemists can not tell sugar syrup honey from the best floral honey. If it is desirable to do so, possibly research may find a method. Undoubtedly most floral honey contains organic extracts, in very small quantities, which may make it possible by very delicate chemical manipulation to distinguish floral from other honey. But if the difference is not perceptible to the taste, and only by the most delicate chemical operations, if at all, I do not see why it is important, though others seem to feel quite differently.

SUMMARY.

We are thus assured by these analysis:

1. That chemists can easily detect adulteration of honey by use of

glucose, in all cases where it is likely to be practiced. The same would be true if cane sugar syrup was mixed with the honey.

2. That a probable method to distinguish honey dew honey from honey adulterated with glucose has been determined by these analyses. The right-handed or slight left-handed rotation together with the large amount of ash, and small amount of invert sugar indicate honey dew honey. As honey dew honey will never be put onto the market, this question is of scientific rather than practical importance.

3. As yet the chemist is unable to distinguish between cane sugar syrup honey —by which we mean cane sugar syrup fed to the bees and transformed by them into honey, and not cane syrup mixed with honey, which is adulteration pure and simple, though a kind not likely to be practiced—and honey from flowers. As the best cultivated taste cannot thus distinguish, this seems of slight importance. If it should prove to be important to be able to distinguish them it is probable that the chemist will discover the means, as chemistry has very delicate eyes, and can usually search out very slight differences.

We see that there are yet unsolved problems in this direction. And it is desirable to follow up the investigations. Prof. H. W. Wiley is desirous to do so till the last fact is discovered. To better accomplish this he desires samples of three or four pounds each of honeys from any *known source*, especially honey dew honey, and that gathered very rapidly. Sugar syrup honey will also be very acceptable. Such samples may be sent to Prof. H. W. Wiley, Division of Chemistry, Department of Agriculture, Washington, D. C. The express will be paid by the Department of Agriculture.

I wish to thank the three distinguished chemists who have rendered such able assistance in determining these valuable results.

A. J. COOK.

AGRICULTURAL COLLEGE, MICH.,
June 29, 1893.

INSPECTION OF COMMERCIAL FERTILIZERS.

No. 97.—Chemical Department.

Act No. 26, session laws of 1885, provides for the inspection of commercial fertilizers in this State. The law has been in force for eight years. It was designed primarily for the protection of farmers, and secondarily to protect honorable manufacturers who place reliable goods upon the market from the competition of untrustworthy dealers who seek to place fertilizers of inferior quality upon the market and sell worthless stuff for high-priced manures. The strict enforcement of the law has driven some inferior goods out of the market, has improved the quality of many fertilizers by keeping manufacturers up to the quality claimed for their goods, and in these several ways has saved thousands of dollars to our people. Michigan has ceased to be the dumping-ground for fertilizers of so poor quality as to be unsalable in other states.

OBJECT OF CHEMICAL ANALYSIS.

In these analyses attention is directed exclusively to nitrogen, potash and phosphoric acid, in form available for the plant. These are not the only materials concerned in raising crops, but they are the only manurial materials for which the farmer can afford to pay more than ten dollars a ton. The common soil materials, lime, magnesia, silica, alumina, oxide of iron, etc., make up the bulk of our soils, which the farmer cannot afford to buy at twenty to thirty dollars a ton to manure his fields made up of the same materials. These common soil materials, aside from nitrogen, potash and phosphates, do not enter into consideration in making up an estimate of the value of any fertilizer.

COMPLAINTS OF DEALERS.

A few dealers complain of the injustice of paying a license fee of twenty dollars, when the profits of the sales for a season may be little more than the license fee, and that they should not be taxed until they had established a paying business. In some states the license fee is graded by the number of tons of fertilizers sold during the year, but that is not the law in this State. Our law was planned for persons who carry on a commercial business and not a huckstering trade. If the business is too small to justify a license it is too small for this climate. It would be manifestly unfair to allow a trade to go forward in hopes of building up a paying trade in competition with dealers who have paid their license fee and demand the protection of the law.

MANUFACTURERS SHOULD PROTECT THEIR RETAIL DEALERS.

By the proviso to section 3 of the law a dealer in this State is not required to take out a license for the sale of any fertilizer if the manufacturer has taken out a license for such fertilizer. In this way the manufacturer can protect all his agents in this State by payment of a single fee. Otherwise each dealer must take out a license. The object of the law is not merely to collect a revenue, but to secure the analysis and certification of every fertilizer sold in the State. If, then, any manufacturer neglects or refuses to take out a license for his goods, it would be a matter of prudence for all dealers to refuse his goods, and sell only the fertilizers of such manufacturers as will protect their agents in the State. If outside manufacturers neglect their State agents, then the law exacts the fee for license from each dealer in the State.

One Cleveland party refuses to pay for a license on nitrate of soda, which is largely used for fertilizer, because they did not manufacture the material and sold it simply as a chemical substance, "and in no State in the Union do we pay a license fee for selling them."

A letter addressed to the person in charge of the chemical department of the Ohio experiment station elicited the reply, "but should it be offered to the farmers as a 'fertilizer' it would have to be registered as such and analyzed, and the packages marked with analysis. The fact of its importation would be of no consequence; we consider merely whether it is on the market as a fertilizer and sold to farmers." In many of the eastern states it is considered as requiring the same treatment for license as other fertilizers. Under these conditions the chloride and sulphate of potassium, nitrate of sodium and similar commercial salts used for fertilizers will require a license fee in this State.

It may seem a hardship to the dealer to require a license from each one for every brand of fertilizer he offers for sale. Yet it is obvious that the system of inspecting and licensing is necessary to protect the farmers from heavy loss. If a license is required of one, it must be required of all.

OBJECT OF INSPECTION OF COMMERCIAL FERTILIZERS.

The law does not prescribe any standard for the composition of a commercial fertilizer, the manufacturer being free to make his own standard, the law simply requiring that the fertilizers offered for sale shall be up to the standard set up by the manufacturer. The license to sell does not certify to the value of the fertilizer, but simply states that the manufacturer or dealer offers for sale a fertilizer for which a certain content of nitrogen, potash and phosphoric acid is claimed, and that samples of such fertilizers have been deposited with the secretary of the college with affidavit regarding the composition. Analysis is then made of each of these fertilizers, gathered in the open market as far as possible, and the results of such analysis published in bulletin. The *claimed* composition and *found* composition are arranged in parallel lines, so that the real composition can be compared at a glance with the composition claimed for it by manufacturer. In this way the buyer can see at once by this bulletin whether the fertilizer is as good as the claims made for it.

WHAT TO LEARN FROM THE ANALYSIS.

The three most valuable materials in commercial manures are potash, phosphoric acid and available nitrogen. Each of these has a commercial value, and the worth of any given quantity in the market may be stated in dollars and cents. Only these three substances are considered in the inspection of commercial fertilizers, because the other materials are of too little value to be purchased at high prices. The essential value of these fertilizers lies in the potash, phosphoric acid and available nitrogen they contain. The law does not prescribe the amount of these substances in any fertilizer, but requires the manufacturer or dealer to certify the composition of the fertilizer, and to deposit a sample of the fertilizer with the Secretary of the State Board of Agriculture. In this way the composition of the fertilizer as claimed by the manufacturer is offered to the public. Samples of the fertilizer are gathered in the open market, and analyzed, and the results directly compared with the claims of the manufacturer in the bulletin. The farmer can thus find in the bulletin, on lines opposite each fertilizer, the amount of nitrogen, phosphoric acid and potash as claimed by the manufacturer, and as actually found by analysis at this laboratory. If the analysis shows more of any given substance than is claimed, the goods are better than claimed; but if much less is found on analysis than is claimed, then the goods are proportionately of less value to the farmer. For example, an Ohio potato fertilizer was sold in the State last year that fell short of the claimed amount of available nitrogen by more than two per cent, and of potash by more than three per cent, and the fertilizer was not worth so much as claimed by $11 a ton. By consulting the tables in the bulletin, the market value of these commercial fertilizers can be estimated on the basis that available phosphoric acid is worth eight cents a pound, insoluble phosphoric acid three cents, potash six cents and ammonia eighteen cents. As there are 20 times 100 pounds in a ton, if we multiply the value of a pound by 20, we get the value of one per cent of each substance, and thus obtain a factor for obtaining the value of the material in a ton from the percentage given in the tables of the bulletin. One per cent means 20 pounds in a ton, and if the material is worth eight cents a pound then each per cent equals $1.60 a ton.

Multiply $1.60 by the per cent. of available phosphoric acid.
" .60 " " insoluble " "
" 3.60 " " ammonia.
" 1.20 " " potash.

The sum will give the market value of a ton of such fertilizer. Take for example Vegetable Bone fertilizer as found last year:

Ammonia 5.76 % × $3.60=	$20.74
Available phosphoric acid 5.40 % × 1.60=	8.64
Insoluble " " 1.48 % × .60=	89
Potash 7.80 % × 1.20=	9.36
Market value per ton	$39.62

The law respecting inspection and licensing commercial fertilizers is again inserted, because so many seem to be ignorant of its provisions:

[Session Laws of 1885, No. 26.]

AN ACT to provide for the inspection of commercial fertilizers and to regulate the sale thereof.

SECTION 1. *The People of the State of Michigan enact*, That any person or persons who shall sell or offer for sale in this state any commercial fertilizer, the retail price of which exceeds ten dollars per ton, shall affix on the outside of every package containing such fertilizer a plainly printed certificate, stating the number of net pounds therein; the name or trade mark under which such article is sold; the name of the manufacturer; the place of manufacture, and a chemical analysis, stating the percentage of nitrogen in an available form; of potash soluble in water, and of phosphoric acid in available form (soluble or reverted) and the insoluble phosphoric acid.

SEC. 2. Before any commercial fertilizer is sold or offered for sale, the manufacturer, importer, or party who causes it to be sold or offered for sale within this state, shall file with the secretary of the State Board of Agriculture a certified copy of the analysis and certificate referred to in section one, and shall also deposit with said secretary a sealed glass jar containing not less than two pounds of such fertilizer, with an affidavit that it is a fair sample of the article thus to be sold or offered for sale.

SEC. 3. The manufacturer, importer, or agent of any commercial fertilizer, the retail price of which exceeds ten dollars per ton as aforesaid, shall pay annually to the secretary of the State Board of Agriculture, on or before the first day of May, a license fee of twenty dollars for each and every brand of fertilizer he offers for sale in this state: *Provided*, That whenever the manufacturer or importer shall have paid this license fee his agents shall not be required to do so.

SEC. 4. All such analyses of commercial fertilizers required by this act shall be made under the direction of the State Board of Agriculture and paid for out of the funds arising from the license fees provided for in section three. At least one analysis of each fertilizer shall be made annually.

SEC. 5. The secretary of the State Board of Agriculture shall publish in his annual report a correct statement of all analyses made and certificates filed in his office, together with a statement of all moneys received for license fees, and expended for analysis. Any surplus from license fees remaining on hand at the close of the fiscal year shall be placed to the credit of the experimental fund of said board.

SEC. 6. Any person or persons who shall sell or offer for sale any commercial fertilizer in this state without first complying with the provisions of sections one, two, and three of this act, or who shall attach or cause to be attached to any such package or fertilizer an analysis stating that it contains a larger percentage of any one or more of the constituents or ingredients named in section one of this act than it really does contain shall, upon conviction thereof, be fined not less than one hundred dollars for the first offense, and not less than three hundred dollars for every subsequent offense, and the offender shall also be liable for damages sustained by the purchaser of such fertilizer on account of such misrepresentation.

SEC. 7. The State Board of Agriculture by any duly authorized agent is hereby authorized to select from any package of commercial fertilizer exposed for sale in this state, a quantity, not exceeding two pounds, for a sample, such sample to be used for the purposes of an official analysis and for comparison with the certificate filed with the secretary of the State Board of Agriculture and with the certificate affixed to the package on sale.

SEC. 8. All suits for the recovery of fines under the provisions of this act shall be brought under the direction of the State Board of Agriculture.

Approved March 10, 1885.

Analysis of Commercial Fer-

Manufacturer.	Trade Name.	Dealer and Locality.
Crocker Chemical Works, Buffalo, N. Y.	Practical Ammoniated Superphosphate	Dan Williams, Morenci, Mich.
Crocker Chemical Works, Buffalo, N. Y.	New Rival Ammoniated Superphosphate	C. C. Van Doren, Adrian
Crocker Chemical Works, Buffalo, N. Y.	Vegetable Bone Superphosphate	C. C. Van Doren, Adrian
Crocker Chemical Works, Buffalo, N. Y.	Potato, Hop and Tobacco Superphosphate	C. C. Van Doren, Adrian
Crocker Chemical Works, Buffalo, N. Y.	Ammoniated Bone Superphosphate	C. A. Slayton, Tecumseh
Crocker Chemical Works, Buffalo, N. Y.	Pure Ground Bone	C. A. Slayton, Tecumseh
Crocker Chemical Works, Buffalo, N. Y.	Ammoniated Wheat and Corn Superphosphate	
Crocker Chemical Works, Buffalo, N. Y.	Buffalo Superphosphate No. 2	Dan Williams, Morenci
Crocker Chemical Works, Buffalo, N. Y.	Special Potato Fertilizer	J. Carpenter, Blissfield
Crocker Chemical Works, Buffalo, N. Y.	Niagara Phosphate	Manufacturer
Crocker Chemical Works, Buffalo, N. Y.	Crocker's Lawn Fertilizer	Manufacturer
Crocker Chemical Works, Buffalo, N. Y.	Ground Bone Meal	Manufacturer
Cleveland Dryer Co., Cleveland, O.	Buckeye Bone Superphosphate	E. W. Spencer, Petersburg
Cleveland Dryer Co., Cleveland, O.	Ohio Seed Maker	Fred Weisenger, Deerfield

* Not licensed: Sale unlawful if the retail price exceeds $10 a ton. Penalty for selling or offering for sale a fine of $100. See Sec. 6 of the law.

The fertilizers that are not starred have been licenses for 1893 and their sale is legal.

tilizers in Michigan for 1893.

	Available Nitrogen.	Phosphoric Acid.			Potash Soluble in H_2O.	
	Estimated as NH_3.	Available P_2O_5.	Insoluble P_2O_5.	Total P_2O_5.	Estimated as K_2O.	Estimated as K_2SO_4.
Claimed	1 to 2	8 to 10	1 to 2	9 to 12	1 to 2	2 to 3
Found	1.10	9.91	1.27	11.18	1.62	2.99
Claimed	1.50 to 2.50	10 to 12	1 to 3	11 to 15	1.60 to 3	3 to 5
Found	1.60	10.05	3.09	13.14	1.74	3.11
Claimed	6 to 7	6 to 7	1 to 2	7 to 9	6 to 8.	11 to 15
Found	6.27	4.22	2.81	7.03	10.41	19.25
Claimed	2.50 to 3.50	10 to 12	1 to 2	11 to 14	3.25 to 4.30	6 to 8
Found	2.46	10.92	.64	11.56	3.36	6.21
Claimed	3.50 to 4.50	10 to 12	1 to 2	11 to 14	1 to 2	2 to 3
Found	5.71	5.73	1.43	7.16	7.92	14.65
Claimed	3.50 to 4.50			25		
Found	5.45			23.02		
Claimed	2.50 to 3.50	10 to 13	1 to 2	11 to 15	1.60 to 2.70	3 to 5
Found	2.80	10.21	3.73	13.94	1.79	3.31
Claimed		11 to 13	1 to 2	12 to 15	1.35 to 2.00	2.50 to 3.50
Found		9.07	2.11	11.18	1.59	2.94
Claimed	4.50 to 5.50	8 to 9	1 to 2	9 to 11	5.40 to 6.40	10 to 12
Found	4.25	7.10	1.82	8.92	5.88	10.87
Claimed		11.50 to 13	1 to 2	12.50 to 15		
Found		11.45	3.51	14.96		
Claimed	5 to 6			18 to 20		6 to 8
Found	5.50			21.34	2.13	3.94
Claimed	2.50 to 4.00			25		
Found	5.20			24.94		
Claimed	3 to 4	9 to 10		11 to 12	1 to 2	
Found	3.82	12.01	2.64	14.65	1.12	2.07
Claimed	1.50 to 2.50	10 to 12		15 to 17		
Found	1.97	9.21	2.81	12.02		

* Not licensed: Sale unlawful if the retail price exceeds $10 a ton. Penalty for selling or offering for sale a fine of $100. See Sec. 6 of the law.

The fertilizers that are not starred have been licensed for 1893 and their sale is legal.

Analysis of Commercial Fertilizers

Manufacturer.	Trade Name.	Dealer and Locality.
Cleveland Dryer Co., Cleveland, O.	Special Potato Fertilizer	Martin & Blood, Hudson
Cleveland Dryer Co., Cleveland, O.	Square Bone	E. W. Spencer, Petersburgh
Cleveland Dryer Co., Cleveland, O.	Ammoniated Dissolved Bone	E. W. Spencer, Petersburgh
Cleveland Dryer Co., Cleveland, O.	* Nitrate of Soda	G. B. Pomeroy, South Haven
Cleveland Dryer Co., Cleveland, O.	* Chloride of Potassium	G. B. Pomeroy, South Haven
Michigan Carbon Works, Detroit, Mich.	Jarves Celery Grower	Geo. Hancock, Grand Haven
Michigan Carbon Works, Detroit, Mich.	Jarves Drill Phosphate	C. B. Waterloo, Port Huron
Michigan Carbon Works, Detroit, Mich.	Homestead Potato Grower	Gill R. Lovejoy, Lenox
Michigan Carbon Works, Detroit, Mich.	Homestead Superphosphate	P. Coddington, Morenci
Michigan Carbon Works, Detroit, Mich.	Banner Dissolved Bone	Geo. Hancock, Grand Haven
Northwestern Fertilizer Co., Chicago, Ill.	Horseshoe Brand Prairie Phosphate	C. B. Waterloo, Port Huron
Northwestern Fertilizer Co., Chicago, Ill.	Horseshoe Brand Corn Grower	Jas. Stevenson & Son, Adrian
Northwestern Fertilizer Co., Chicago, Ill.	Horseshoe Brand Garden City Superphosphate	C. B. Waterloo, Port Huron
Northwestern Fertilizer Co., Chicago, Ill.	Celery Grower	J. F. Farnum, Kalamazoo
Northwestern Fertilizer Co., Chicago, Ill.	Horseshoe Brand Fine Raw Bone	C. A. Slayton, Tecumseh

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*Not licensed: Sale unlawful if the retail price exceeds $10 a ton. Penalty for selling or offering for sale, a fine of $100. See section 6 of the law.

in Michigan for 1893.—Continued.

	Available Nitrogen.	Phosphoric Acid.			Potash Soluble in H_2O.	
	Estimated as NH_3.	Available P_2O_5.	Insoluble P_2O_5.	Total P_2O_5.	Estimated as K_2O.	Estimated as K_2SO_4.
Claimed	4 to 5	8 to 10	----------	10 to 14	4 to 6	----------
Found	4.01	7.71	.40	8.11	6.51	12.04
Claimed	3 to 4	6 to 10	----------	20 to 25	----------	----------
Found	3.84	13.87	8.66	22.53	----------	----------
Claimed	1.50 to 2.50	10 to 12	----------	15 to 18	----------	----------
Found	2.09	10.17	3.95	14.12	----------	----------
Claimed	----------	----------	----------	----------	----------	----------
Found	18.31	----------	----------	----------	----------	----------
Claimed	----------	----------	----------	----------	----------	----------
Found	----------	----------	----------	----------	80.4	----------
Claimed	1	----------	----------	1	1	----------
Found	1.90	10.66	1.08	11.74	3.27	6.04
Claimed	1.25 to 2	8.50 to 9.50	2 to 3	10.50 to 12.50	----------	----------
Found	1.46	7.53	2.14	9.67	----------	----------
Claimed	3 to 4	9.50 to 11	.50 to 1.50	10 to 12.50	----------	6.50 to 7.50
Found	3.58	9.19	2.22	11.41	3.62	6.70
Claimed	1.85 to 2.40	7.50 to 11	----------	----------	----------	2.75 to 3.50
Found	2.93	8.39	1.20	9.59	1.75	3.23
Claimed	----------	34 to 38	----------	36 to 40	----------	----------
Found	----------	24.17	6.65	30.82	----------	----------
Claimed	2 to 2.50	----------	----------	9 to 11	----------	----------
Found	1.90	7.73	3.01	10.74	----------	----------
Claimed	2.50 to 3.00	8 to 9	----------	----------	.54 to 1.08	----------
Found	3.13	10.30	3.77	14.07	1.11	2.05
Claimed	2.50 to 3.00	8 to 9	4 to 4.50	12 to 13.50	.54 to 1.08	----------
Found	2.73	10.10	2.56	12.66	.81	1.49
Claimed	3 to 4	7 to 9	----------	7 to 9	----------	2 to 3
Found	3.02	8.89	6.74	15.63	.74	1.36
Claimed	3 to 4	----------	----------	22 to 24	----------	----------
Found	2.08	----------	----------	22.64	----------	----------

Analysis of Commercial Fertilizers

Manufacturer.	Trade Name.	Dealer and Locality.
W. S. Dunbar, St. Joseph, Mich.	Meat and Bone	Manufacturer
W. S. Dunbar, St. Joseph, Mich.	Fish Guano	Manufacturer
Bradley Fertilizer Co., Boston, Mass.	* Bradley's Dissolved Bone with Potash	C. Kraling, Kalamazoo
Bradley Fertilizer Co., Boston, Mass.	* Sea Fowl Guano	C. Kraling, Kalamazoo
Pottstown Iron Co., Pottstown, Pa.	Odorless Phosphate	C. A. Slayton, Tecumseh
Lister's Agricultural Chemical W'ks, Newark, N. J.	Lister's Success	John McCullough, Ypsilanti
Joseph Lister, Chicago, Ill.	Pure Bone Meal	C. B. Waterloo, Port Huron.
H. J. Baker & Bros., New York, N. Y.	Complete Lawn Dressing Manure	Alfred Brown, Grand Rapids
H. J. Baker & Bros., New York, N. Y.	Grade "A" for Potatoes, Special Truck Manure	Alfred Brown, Grand Rapids
Grand Rapids Glue Co., Grand Rapids, Mich.	Non Plus Ultra	Manufacturer
Michigan Phosphate Co., Saginaw, Mich.	Pure Ground Bone	Manufacturer
Michigan Phosphate Co., Saginaw, Mich.	Rich Harvest	Manufacturer
Michigan Phosphate Co., Saginaw, Mich.	Bone and Meat	Manufacturer
Cincinnati Dessicating Co., Cincinnati, O.	* Phœnix Phosphate	A. J. Hasbrouck & Co., Hudson
Cincinnati Dessicating Co., Cincinnati, O.	* Gilead Phosphate	A. J. Hasbrouck & Co., Hudson

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* Not licensed: Sale unlawful if the retail price exceeds $10 a ton. Penalty for selling or offering for sale a fine of $100. See Sec. 6 of the law.

The fertilizers that are not starred have been licensed for 1893 and their sale is legal.

in Michigan for 1893.—Continued.

	Available Nitrogen.	Phosphoric Acid.			Potash Soluble in H_2O.	
	Estimated as NH_3.	Available P_2O_5.	Insoluble P_2O_5.	Total. P_2O_5.	Estimated as K_2O.	Estimated as K_2SO_4.
Claimed						
Found	5.79	4.68	6.24	10.92	.65	1.20
Claimed						
Found	8.05	2.44	2.04	4.48	.97	1.75
Claimed	1 to 2	6 to 8		10 to 12	4 to 6	
Found	1.20	6.59	2.75	9.34	2.12	3.92
Claimed						
Found	2.07	9.20	3.03	12.23	2.00	3.70
Claimed		4.92		20.87		
Found		7.79	12.17	19.96		
Claimed	1.25 to 2			10.50 to 12.00	1.50 to 2	
Found	1.82	9.22	1.85	11.07	2.11	3.85
Claimed	3.05			24.65		
Found	3.74			26.27		
Claimed	4.50 to 5	5 to 6			7.50 to 9	
Found	2.60	4.91	1.08	5.99	12.73	23.55
Claimed	3 to 6	5 to 8			7 to 10	
Found	5.26	4.15	2.81	6.96	13.81	25.54
Claimed						
Found	3.82	.96	6.38	7.34	.58	1.08
Claimed	4.50 to 5.50			21 to 24		
Found	3.07			26.25		
Claimed	2 to 3			9 to 11	1 to 2	
Found	3.31	6.14	5.63	11.77	1.41	2.60
Claimed	3.50 to 5			10 to 13	2 to 3	
Found	3.92	9.27	6.26	15.53	1.80	3.33
Claimed						
Found	2.66	7.78	3.37	11.15	1.02	1.88
Claimed						
Found	3.36	9.65	4.09	13.74	2.08	3.84

Analysis of Commercial Fertilizers

Manufacturer.	Trade Name.	Dealer and Locality.
Swift & Co., Chicago, Ill.	Swift's Steamed Bone	H. Roossiew, Grand Haven
Swift & Co., Chicago, Ill.	Swift's Pure Raw Bone Meal	G. W. Miller, Grand Haven
Swift & Co., Chicago, Ill.	* Swift's Dried Blood	Martin Keift, Grand Haven
Swift & Co., Chicago, Ill.	* Swift's Tankage	Martin Keift, Grand Haven
Oakfield Fertilizer Co., Buffalo, N. Y.	Potato and Tobacco Phosphate	C. C. Corwin, Grass Lake
Oakfield Fertilizer Co., Buffalo, N. Y.	Great Value	Peter Grinnell, Richmond
Oakfield Fertilizer Co., Buffalo, N. Y.	Domestic Fertilizer	C. C. Corwin, Grass Lake
Jarecki Chemical Co., Sandusky, O.	Lake Erie Fish Guano	Wm. Rothfuss, Blissfield
Jarecki Chemical Co., Sandusky, O.	C. O. D. Phosphate	Manufacturer
Jarecki Chemical Co., Sandusky, O.	Ground Bone	Manufacturer
Ypsilanti Plant Food Co., Ypsilanti, Mich.	* Odorless Lawn Dressing	Miss Rogers, Ann Arbor
American Cutlery Co., Chicago, Ill.	* Fine Bone Meal	Alfred Brown, Grand Rapids
James Boland, Jackson, Mich.	Blackman Fertilizer	Manufacturer

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* Not licensed: Sale unlawful if the retail price exceeds $10 a ton. Penalty for selling or offering for sale, a fine of $100. See Sec. 6 of the law.

in Michigan for 1893.—Concluded.

	Available Nitrogen.	Phosphoric Acid.			Potash—Soluble in H_2O.	
	Estimated as NH_3.	Available P_2O_5.	Insoluble P_2O_5.	Total. P_2O_5.	Estimated as K_2O.	Estimated as K_2SO_4.
Claimed	3.50 to 4.50			25 to 30		
Found	3.82			25.35		
Claimed	4.50 to 5.50			25 to 27		
Found	4.94			24.69		
Claimed						
Found	16.69			.44	.21	.38
Claimed						
Found	9.26			8.60		
Claimed	3 to 4	6 to 8	1 to 2	7 to 10		8 to 10
Found	1.85	8.05	.83	8.88	4.91	9.08
Claimed	1 to 2	6 to 8	1 to 2	7 to 10		2 to 3
Found	1.20	6.72	1.03	7.75	1.42	2.62
Claimed	2 to 3	8 to 10	1 to 2	9 to 12		2 to 3
Found	1.64	8.27	1.02	9.29	1.95	3.60
Claimed	2.50 to 3	10 to 12		12 to 14	1 to 2	
Found	2.22	10.57	3.78	14.35	.56	1.03
Claimed						
Found		11.43	4.99	16.42		
Claimed						
Found	5.51			21.15		
Claimed						
Found				19.96		
Claimed						
Found	4.77			25.48		
Claimed						
Found	1.05	5.38	1.31	6.69	.27	.49

For the information of the parties concerned, the fertilizers that have been licensed for 1893 are contained in the list of this bulletin; also those that have not been licensed and whose sale is illegal in this state will be marked with a star.

The primary object of this law is to give information in regard to the composition of commercial fertilizers, and to protect farmers from imposition and loss. The question of their agricultural value, and relation to crops and different kinds of soils is not touched. These subjects require a separate examination for determining the relative value of any given fertilizer with reference to different soils and crops. The farmer can settle for himself such questions by trials of the fertilizer on a small portion of a field by comparing the results with other parts of the same field and crop on which no fertilizer has been applied. The conditions of crop, soil, and climate are thus brought home to him more completely than any investigation in other places and conditions can furnish.

How the state may place before the farmers the agricultural value of the various fertilizers offered for sale is a very different subject from that contemplated by this law for the inspection of such fertilizers. The law of inspection offers no advice whether the farmer shall buy such fertilizers, or depend upon the home supply. In case he determines to buy, it affords him some basis for calculating the commercial value of the different brands offered for sale, and to select honest goods which are found to be the same in the market as are claimed by the seller. He may also be on his guard not to buy the goods which are not licensed for sale as not worthy of confidence.

With this brief statement of the objects sought by inspection, and the results of analysis of goods selected in the open market as compared with the claims of the manufacturer, this Bulletin is submitted to the public.

R. C. KEDZIE,
Chemist of Experiment Station.

AGRICULTURAL COLLEGE,
July 12, 1893.

LOCUSTS AND THE HORN FLY.

No. 98—Zoölogical Department.

LOCUSTS.

Within the past year or two many reports have been received from various parts of the State regarding depredations made by grasshoppers, locusts and allied insects. They have been doing much damage to meadows, lawns and pastures, injuring fields of oats just before they are ready to cut, and doing much harm to the fields of peppermint in the southern counties where this plant is so extensively grown for its flavoring extracts. At the college and vicinity the locusts have not been especially numerous as far as known, and so no special experiment work has been done as to means of prevention or their destruction. Several states that have been suffering from similar attacks have endeavored to find suitable remedies and recommended the best means found by them. Hoping that what has already been learned and reported in other states will be of value to people in many regions of this State, when in accessible form, the present bulletin has been issued.

Two of our most common locusts:

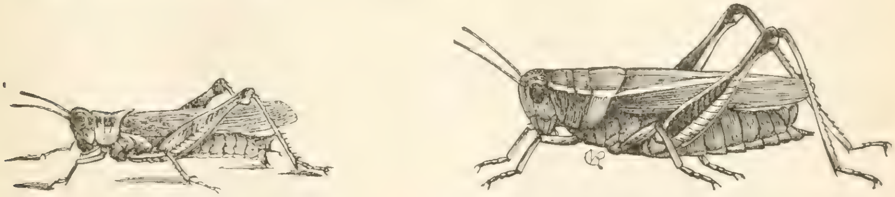

Fig. 1, (*a*) The red-legged locust, *Melanoplus femur-rubrum.* (after Riley.)

(*b*) The two-stripped locust, *Melonoplus bivittatus.* (after Riley.)

Fortunately for the people of Michigan they need never fear an invasion from the Rocky Mountain locust that so often devastes the crops in many of the western states. It is a migrating locust which travels in large armies. Although quite small in size these locusts eat every living plant that grows in their path, but have never been known to migrate farther east than the Mississippi. Our species of locust (commonly called grasshoppers) that injure our crops, travel very little through the season which is to them their lifetime. The young hoppers at first have no wings and can travel only by jumping. Later in the season when they reach maturity they have fully developed wings are then able to travel farther and easier.

The eggs are placed in the ground, preferably on some sand knoll or ridge, as far as I have observed. There will be found probably from 100 to 150 deposited by each female in the autumn in an oblong case nearly an inch under the surface. The eggs are all tightly glued together in the case so that they are well protected from cold and wet through the winter. With the coming of the bright warm days of spring the young locust emerges from its subterranean home and takes its first meal on the tender blades above. Its jaws are large and strong and moved by powerful muscles. All through its summer life it has a strong appetite and grass and other plants suited to its taste disappear surprisingly fast for the work of so small a creature.

At the Iowa Station* careful estimates have been made of the injury done to pastures and meadows by the various insects that feed there, and it is thought that one-half or more of the grass in that state is lost in this way. This loss in Iowa, and Michigan as well, is not alone through the grasshoppers and locusts. Crickets aid considerably, and there are also myriads of smaller insects known as leaf-hoppers which are usually overlooked because of their diminutive size. Besides these there are dozens of other species of insects that are always present in greater or less numbers. They all come in for their share of feed though seldom thought of or considered in estimating our loss. As it is larger and more conspicuous and so more easily seen, the locust is usually held accountable for the whole loss. The loss of crops is more noticeable in a dry season. The tendency of such a season is to favor the development of locusts, but the work becomes more apparent largely because the plant is unable to recover its loss so readily as in a more favorable season.

REMEDIES.

Owing to the large area over which the locusts and other grass feeding species are found, the suggesting of a remedy is made rather more difficult. The use of remedies in the usual limited way is entirely impracticabe and it is only by the means of some inexpensive, wholesale destruction that we must look for relief.

Molasses and bran makes a very attractive morsal for locusts, and a little arsenic mixed with the two and sprinkled through the fields where the locusts feed, is reported from some badly eaten districts as being a very good means of ridding the fields by killing the locusts by the thousand. Such means might be used in the oatfield, meadow or cultivated field, but not where stock is pasturing.

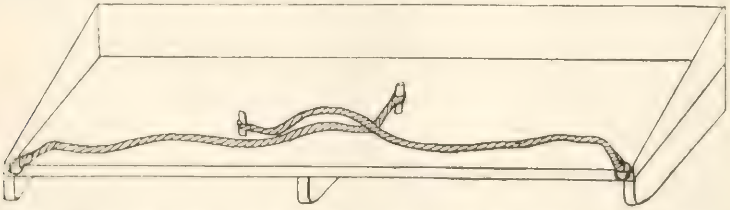

Fig. 2. "Hopper dozer," for catching locusts and similar insects. (After Smith.)

The best and most certain method is to collect the locusts mechanically. The best means of doing this is by a collector known as a "hopper dozer."

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*Bulletin No. 13, Iowa Agricultural Experiment Station, page 95.

It is made of light sheet iron ten to fifteen feet long by about three feet wide. The front should roll up half an inch or an inch to give a smooth face, while the back should be from six inches to a foot deep and side pieces to correspond. The inside of the pan should then be coated nearly half an inch deep with coal tar, and with a rope attached on either side the dozer is ready for use. Two persons can easily run such a pan, but horses may readily be attached to a larger one. The principle is all that is necessary to suggest and then each one can arrange details to suit the occasion. Whatever is used to draw the hopper dozer should be at either end, else the locusts would be driven each side before the tarred pan reached them. Of course at the approach of the machine the locusts leap and usually alight on the tar. The winged ones may fly entirely over, and often a stiff wire or stick placed a few inches in front of the dozer will help, as the plants will be stirred and start the locusts up sooner and drop them where desired. If very numerous, the insects will soon cover the tar, so that an occasional new supply will be needed. It is best of course to use the hopper dozer on the locusts as soon as they are noticed in numbers. At this time they will not be full fledged and can be caught easier. If they are mostly winged ones, fewer would escape if taken in the cooler parts of the day when they are not so active and are more apt to hop than fly. For pastures, and meadows with short grass, no runners are needed under the hopper dozer, but for peppermint and such plants that are higher and more tender, runners that will raise it high enough not to break the plants may be easily put on. They can be placed so as to run between rows at any distance desired. By going over the badly affected fields in this way several times at short intervals, a great deal is saved at a slight expense. At the Iowa station it is estimated that even where all the help is hired, the expense of each collecting does not exceed ten cents per acre.*

A good deal may be done in the way of prevention by plowing and cultivating land known to be breeding ground for the locusts. Many of the egg cases are broken by plowing and working the soil, and the eggs are much less liable to hatch. Should they hatch, the young are unable to penetrate soil well packed over them, and for this reason thorough cultivation with frequent rolling of such fields is to be commended. Dead grass, rubbish, etc., serve as a winter protection and should be cleaned up or burned in the autumn.

G. C. DAVIS.

THE HORN FLY.

Haematobia serrata.

ORDER DIPTERA. FAMILY MUSCIDÆ.

A small two-winged fly that is likely to appear in swarms on stock this summer and to be very annoying to them by its bite, causing them to lose in flesh and flow of milk.

The spread of this stock pest over the State this year seems certain. Less than five years ago it was unknown to the United States. In the fall of 1887 it appeared in southern New Jersey, but was not numerous enough to attract special attention till 1889. Since that time it has spread throughout the eastern part of the United States and from the Gulf of Mexico into Canada. It reached Michigan late last season and was reported from Manchester and several other places in the southeastern portion of the State. The rapidity with which it spreads is wonderful. As many of the stock farms will probably receive a visit this season a knowledge of the fly and its habits, along with the best means of thwarting severe attacks, will be opportune.

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*Bulletin No. 14, of the Iowa Agricultural Experiment Station, page 172.

For a thorough study of the habits and life history of the fly we are indebted to Dr. Riley and his assistants of the Department at Washington, D. C.,* and to Prof. Smith of the New Jersey Statson,† who both investigated it independently and have suggested about the same remedies.

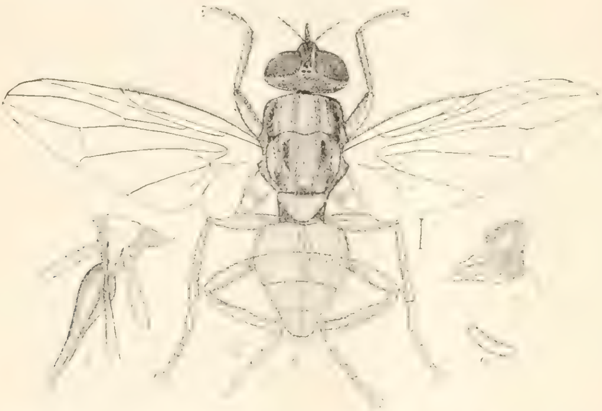

FIG. 3. *a*, egg; *b*, imago; *c*, head from the side; *d*, mouth parts. The line at the right shows the natural size of the fly. All are greatly magnified. (After Smith).

The name horn fly is given this species because of the habit of settling on the base of the horns when resting. When very numerous the flies will cover the base of the horns for several inches so completely that they cannot be seen. This habit is especially noticeable in the early part of the season. But little if any injury is done by the fly while here, except by its presence to keep stock that is inclined to be nervous, in an uneasy condition. The real worry and harm comes when the flies are feeding on the stock. They bite quite like the mosquito, pierce the flesh by the use of a find lancet, shown at *d* (Fig. 3), and then sucking the blood through the tube or sheath. A small amount of iritating saliva is secreted in the operation and this causes congestion around the wound and probably more pain than the piercing. While in the act of biting the flies bury themselves in the hair with the wings remaining spread as shown in the cut. This is very characteristic of the fly. It enables them to rise out of danger very quickly should the tail or head be thrown in that direction, but they are back and at work again as quickly as they left. When numerous the effect upon thin skinned stock is to set them almost frantic; while others may not mind it nearly as much. The tendency upon all, however, is to reduce them in flesh, and with dairy cows to also decrease the flow of milk. It is said that the flies confine their attacks solely to horned cattle. If this is so, it is quite a point in favor of dehorning.

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* Insect Life, Vol. II, pp. 93-103.

† Bulletin No. 62, of the New Jersey Agricultural Experiment Station, Nov., 1889.

THE FLY.

The Horn Fly is an introduced species probably brought over from Europe along with some importations of cattle, but just when or how is unknown. In size the fly is only about half as large as the common house fly (*Musca domestica*) which it resembles closely in a general way, but differs in many minute points. It is of a nearly uniform dark ash gray, almost black, while the house fly has distinct gray bars on the thorax and flesh colored patches at the base of the abdomen on either side. There is still more of a difference between it and the common cattle fly (*Stomoxys calcitrans*) found feeding on the legs and other parts of the cattle later in the season. This latter is about the size of the house fly and has a light dusty gray appearance with darker bars on the thorax and seven dark spots on the abdomen. The horn fly will most usually be recognized at once by its peculiar habit of appearing in swarms and in feeding with the wings spread, but should this and the brief comparison with the other two common species be insufficient, the following original description by Dr. Williston may aid and so is given.

"*Male.*—3.5 to 4 m. m. Sides of the front gently concave, in its narrowest width about equal to one-fourth the length of the front from the foremost ocellus to the base of the antennæ; in the middle a narrow dark brown stripe; a single row of slender bristles on each side. Antennæ brownish red; second joint slightly tumid; third joint a little longer than broad, with its inferior angle rectangular; arista swollen at base (which is black); the pectinations long. The narrow sides of the front, and the still narrower facial and genial orbits, silvery gray, with a slight yellowish cast; facial fovæ and cheeks blackish, the latter clothed with yellowish hair. Palpi black, the inner surface and immediate base more yellowish; gently spatulate in shape, nearly as long as the proboscis, and extending two-thirds of their length beyond the oral margin. Mesonotum sub-shining black in ground color, but mostly concealed beneath a brownish dust, and with only faint indications of stripes. Dust on the pleura more grayish. Abdomen with similar dust; in the middle with a more brownish, sub-interrupted stripe, and narrow dark posterior margins to the segments. Femora black or very deep brown; first two pairs of tibiæ and tarsi brownish yellow or luteous, the hind tibiæ and tarsi blackish brown; hind tibiae on the posterior surface with noticeable, erect, subapical bristles; hind tarsi about as long as their tibiæ, the first three joints widened from base to tip of each, so as to form a distinct serration on their inner acute angles, each of which terminates in a long hair. Wings with a light blackish tinge (due to microscopic pubescence), the immediate base yellowish; first posterior cell rather symmetrically narrowed, to terminate broadly at the extreme tip of the wing.

"*Female.*—Front straight on the sides, its width about equal to one-half the distance from the foremost ocellus to the base of the antennæ; the median deep brown stripes about as the lateral pruinose portion. Palpi yellow, with the margins and tips blackish. Legs more yellowish; hind tarsi regular; pulvilli and claws small."

LIFE HISTORY.

As far as known, the fly breeds entirely in manure fresh from the stock. The depositing of eggs is described in Insect Life (loc. cit.) as follows: "As the operation commenced forty or fifty of the flies moved from the flank to the back of the thigh near the "milk mirror," and at the close of the operation they were seen to dart instantly to the dung and to move quickly over its surface, stopping but an instant to deposit an egg. The abdomen and ovipositor were fully extended and the wings were held in a resting position. Most of them had left the dung at the expiration of a minute. Every individual had returned to the cow, however, in a little over a minute." This transpires mostly late in the forenoon, and as high as three hundred eggs have been found in a single dropping. The eggs hatch in about twenty-four hours and grow into yellowish white footless larvæ, three-eights of an inch in length, tapering gradually to a pointed head. They then shrink into red-brown barrel-like pupæ, and later appear as a fly, completing the cycle of life in from ten to seventeen days. In this way it is estimated there will be at least eight generations through a season. With such rapid reproduction, it is easy to account for the sudden appearance of such great numbers.

REMEDIES.

So far preventatives or repellants have been found to be preferable to substances that will kill the flies. Greasy substances of almost any kind prove to be the best preventatives. Dr. Riley says, "A number of experiments were tried in the field with the result that train oil alone, and train oil with a little sulphur or carbolic acid added, will keep the flies away for five or six days, while with a small proportion of carbolic acid it will have a healing effect upon sores which may have formed. * * * Train oil or fish oil seems to be more lasting in its effects than any other of the substances used."

"X. O. Dust" is recommended highly by Prof. Smith (loc. cit.) for killing the flies by keeping the cattle well dusted with it.

The most certain means of destruction is to kill the flies in the early stage. This can be accomplished by throwing a shovel full of lime or land plaster upon each dropping made by the stock. They will be found most common in shady places that the cattle frequent, and by treating them in this way once in two or three days, while the dung is yet fresh, the fly will be destroyed in large numbers while still in its infancy.

Prospects are that if we can stay the fly off for a few years, it will then not trouble us so seriously. The following recently received from Prof. Smith is encouraging. "For the past two or three years the Horn Fly has been no more troublesome in this state (New Jersey, where it first appeared) than the ordinary cow fly, *Stomoxys calcitrans*. It is in new localities that it seems to be most troublesome, becoming gradually less abundant after the third or fourth year."

G. C. DAVIS.

THE SOILS OF MICHIGAN.

No. 99.—Chemical Department.

No state in the union has suffered more in reputation from false statements and ignorant misrepresentation than Michigan. At the time of its first settlement, to the popular apprehension the far-off and unknown Michigan was only, and would forever remain, the home of the wolf, the Indian and ague. By the white man it was uninhabited and uninhabitable. In a report made to a religious body in regard to the feasibility of establishing missionary stations in order to christianize this heathen wild, it was stated that the project was impracticable, "because only a narrow strip along the border of the territory was inhabitable, the interior being a vast and impenetrable swamp."

In his address at the laying of the corner stone of the new capitol in 1872. Hon. W. A. Howard made the following extract from the report of the surveyor general of Ohio, bearing date November 30, 1815: "The country on the Indian boundary line, from the mouth of the great Auglaize river and running thence for about fifty miles is (with few exceptions) low, wet land, with a very thick growth of underbrush, intermixed with very bad marshes, but generally very heavily timbered with beech, cottonwood, oak, etc.; thence continuing north and extending from the Indian boundary eastward, the number and extent of the swamps increase, with the addition of numbers of lakes from twenty chains to two or three miles across. Many of the lakes have extensive marshes adjoining their margins, sometimes thickly covered with a species of pine called tamarack, and other places covered with a coarse, high grass and uniformly covered from six inches to three feet (and more at times) with water. The margins of these lakes are not the only places where swamps are found, for they are interspersed throughout the whole country, and filled with water, as above stated, and varying in extent. The intermediate space between the swamps and lakes, which is probably near one-half of the country, is with a very few exceptions a poor, barren, sandy land, on which scarcely any vegetation grows, except very small scrubby oaks. In many places that part which may be called dry land is composed of little short sand hills, forming a kind of deep basins, the bottoms of many of which are composed of marsh, similar to the above described. The streams are generally narrow and very deep, compared with their width, the shores and bottoms of which are (with a very few exceptions) swampy beyond description; and it is with the utmost difficulty that a place can be found over which horses can be conveyed.

"A circumstance peculiar to that country is exhibited in many of the marshes by their being thinly covered with a sward of grass, by walking on which evinced the existence of water or a very thin mud immediately under their covering, which sinks from six to eighteen inches from the pressure of the foot at every step and at the same time rising before and behind the person passing over. The margins of many of the lakes and streams are in a simular situation and in many places literally afloat. On approaching the eastern part of the military lands towards the private claims on the straits and lake, the country does not contain so many swamps and lakes, but the extreme sterility and barrenness of the soil continues the same. Taking the country altogether, so far as has been explored and to all appearances, together with the information received concerning the balance, it is so bad there would not be more than one acre out of one hundred, if there would be one out of one thousand that would, in any case, admit of cultivation."

From the number of persons who have continued to decry Michigan in whole or in part it would seem that the surveyor general of Ohio had a large family. But as settlers poured into the new territory they were surprised and delighted to find, instead of impassable bogs and sterile sandhills, a region of wonderful beauty and fertility. Thus one county after another was rescued from the supposed dominion of chimeras dire, and pronounced to be the best farm lands on which the sun shines. But who shall say how many persons have been deterred by such ignorant and reckless assertions from making their home in the best state in our union? Sin drove the first pair from the primal Eden, but ignorance has barred out thousands of their children from many an earthly paradise.

GEOGRAPHICAL POSITION.

When we cast our eyes upon the map of our country we are struck with the unique position which our peninsula occupies in comparison with other lands in the same latitude and mark how Nature clasps with her protecting arm of *water* the "beautiful peninsula" and pours out the vast "unsalted seas" a rampart against the cold. Its geographical position and surroundings point it out as eminently fitted for productive industry, while its easily available water carriage will save it from the blighting influence of monopoly in transportation. The watered-stock of railways find more than a match in the water ways of our system of lakes, drowning out monopoly of transportation. Michigan is planted on the highway of nations—the highway of commerce that must last "as long as grass grows and water runs." Such a region must occupy a prominent position in the world's industries and commerce, unless these exceptional advantages are offset by unusual disabilities.

LUMBERING VS. FARMING.

The vast wealth of Michigan in lumber has so filled the public eye that it could not see the greater wealth of its soil. Men seemed to assume that the better it was for lumber the worse it must be for agriculture—as if a soil that could sustain such a wonderful forest growth must be incapable of growing anything but wood. As a consequence men seeking for new lands to make new homes have turned their back on rich soils, well watered lands, ready markets, available transportation, schools and churches.

security and civilization to seek in the far west their resting place amid the alternate parching heat and deadly cold, and the wild disorder, discomfort and insecurity of border life. They reached for sunset and grasped a shadow. The great mass of these restless wanderers have rejected Michigan for a home because they were ignorant of this region—of its soil, productions, capabilities for cultivation, and it adaptedness to make desirable homes.

ANALYSIS OF MICHIGAN SOILS.

Desirous of obtaining reliable data for estimating the value of our soils, I sent out a circular fifteen years ago asking for representative soils from all the counties of the State, for chemical analysis, calling for soils that would be fairly representative of the locality, and not soils of exceptional quality. In response to this circular, thirty-one samples of soil were received, analyzed and the results of analysis published in the report of the State Board of Agriculture for 1878. Some attention was also directed to the physical properties of the soil, especially as related to water.

When chemistry was first applied to agriculture, it was supposed that the greatest benefit which chemistry could confer upon agriculture was to be derived from the analysis of the soil. The striking results which Sir Humphrey Davy obtained by analysis of a soil, barren from excess of the sulphate of iron, and the removal of the barrenness by adding lime to decompose the sulphate, confirmed the impression of the signal benefit to be derived from a chemical analysis of the soil. It was supposed that the fertility of any soil, the kind of crop it was fitted to raise, or the material which must be added to the soil to develop its greatest productiveness, were each and all to be determined simply by a chemical analysis of the soil. These extravagant expectations have not been realized. It was found that chemical analysis will not always distinguish between a fruitful and an unfruitful soil. A soil may be unproductive for physical reasons, though it may still contain all the chemical elements of fertility. The complete failure of Liebig's mineral theory of manures when put to the test of experience rang the knell of mere soil analysis.

But if chemical analysis failed when so much was demanded of it, we are not to go to the other extreme and conclude that because it is not good for so many things it is good for nothing. Chemical analysis of the soil is of value in determining whether a soil is capable of fertility or the contrary; also in determining the measure of its possible fertility. There are certain ash elements which are absolutely necessary for plant growth, in the absence of any one of which vegetable growth is impossible; if the supply is relatively limited, plant growth will be limited correspondingly. If all the ash elements are present in sufficient amount and in available form, such soil is capable of fertility. Hence, chemical analysis of a soil is of importance in determining possibility of fertility and of the relative fertility which may be secured under favorable conditions.

CLASSIFICATION OF MICHIGAN SOILS.

No minute and technical classification of soils is attempted. The soils are classed rather for their agricultural uses than their chemical composition; the geographical position and climatic conditions in some cases affording a basis for classifying, e. g., the peach lands.

A word of explanation in regard to the meaning of the tables of analysis may be proper. To any one not familiar with agricultural chemistry, such tables will appear very dry and uninteresting, or even unintelligible. In these tables sand and silicates, alumina and oxide of iron make much the largest part of most soils. Everyone is familiar with sand; alumina is the basis of clay, and oxide of iron gives the brownish color to most soils. The great bulk of nearly all soils is made up of sand, clay and oxide of iron. Alumina is never found in the ash of cultivated plants; a certain amount of silica and oxide of iron is found in the ash of all plants; but the great mass of these materials as found in the soil is in large excess of the demands of the plant, and is of no worth in the chemistry of plant life; they are the mechanical agents of the soil, and are of worth mainly from their relations to temperature, moisture and the mechanical support of plants; their chief office in the soil is physical and not chemical, rendering the soil light or heavy, porous or retentive. The organic matter of the soil, besides furnishing a supply of combined nitrogen, is valuable for its physical relations to temperature, moisture and porosity of soils, and because it is an active agent in securing chemical changes in the soil, bringing the reserve elements of plant growth into active form.

The numbers attached to the following analyses refer to sample bottles of soils placed in the exhibit of the Experiment Station of the Michigan Agricultural College in the World's Fair, and to coresponding sample bottles in the Michigan State Exhibit in Agricultural Hall and one other set of such bottles at the Michigan Agricultural College. By referring to these sample bottles the reader can find the soils as well as learn their chemical composition.

I. *Wheat Lands. Nos. 1 to 9.*

A large part of the soils of Michigan are well fitted for the growth of winter wheat, and it might seem invidious to select any portion as wheat lands in particular, but the four southern tiers of counties are so specially adapted to this crop that they may be called the wheat belt.

No. 1.—River Raisin Bottoms, Deerfield, Lenawee, County.

Selected by Geo. H. Kedzie.
Forest Growth: Ash, Baswood, Hickory, Black Walnut, Oak, etc.
Soil cultivated forty years, without manure.

Sand and silicates	58.17
Alumina	6.48
Oxide of iron	7.62
Lime	1.98
Magnesia	1.43
Potash	1.81
Soda	1.20
Sulphuric acid	.32
Phosphoric acid	.40
Organic matter containing .42 Nitrogen	10.97
Water	9.45

Capillary capacity for water, 65.60

No. 2.—River Raisin Bottoms, Deerfield, Lenawee Co.

Selected by Geo H. Kedzie.
Virgin soil.
Timber: Ash, Basswood, Black Walnut, Oak, etc.

Sand and silicates	62.42
Alumina	10.64
Oxide of iron	3.46
Lime	2.10
Magnesia	1.59
Potash	2.05
Soda	1.19
Sulphuric acid	.24
Phosphoric acid	.41
Organic matter containing .37 Nitrogen	9.39
Water	6.08

Capillary capacity for water, 61.20

No. 3.—Burr Oak Wheat Lands, Saline, Washtenaw county.

Selected by J. S. Wood.
Timber: Burr Oak.

Sand and silicates	81.00
Alumina	5.23
Oxide of iron	4.66
Lime	1.28
Magnesia	.86
Potash	1.18
Soda	.19
Sulphuric acid	.42
Phosphoric acid	.40
Organic matter containing .11 nitrogen	2.98
Water	1.72

Capillary capacity for water, 36.30.

No. 4.—Prairie Soil, Volinia, Cass Co.

Selected by M. J. Gard.
Soil has been pastured but never cultivated.

Sand and silicates	63.77
Alumina	3.72
Oxide of iron	5.11
Lime	2.02
Magnesia	.66
Potash	1.18
Soda	.56
Sulphuric acid	.13
Phosphoric acid	.44
Organic matter containing .23 nitrogen	12.30
Water	10.19

Capillary capacity for water, 73.20.

No. 5.—Prairie Soil, Volinia, Cass Co.

Selected by M. J. Gard.
Soil has been cultivated for thirty years, has been plastered.

Sand and silicates	75.74
Alumina	4.20
Oxide of iron	5.46
Lime	1.38
Magnesia	.56
Potash	1.10
Soda	.43
Sulphuric acid	.18
Phosphoric acid	.33
Organic matter containing .21 nitrogen	7.50
Water	3.10

Capillary capacity for water, 50.55.

No. 6.—Bottom lands of Tittabawassee.

Selected by Geo. F. Ball.
Timber: Beech, maple, oak and basswood.

Sand and silicates	67.20
Alumina	6.31
Oxide of iron	7.91
Lime	1.64
Magnesia	1.23
Potash	1.85
Soda	1.15
Sulphuric acid	.30
Phosphoric acid	.49
Organic matter containing .22 nitrogen	7.48
Water	4.00

Capillary capacity for water, 51.40.

No. 7.—Garden Soil, Agricultural College.

Shlected by R. C. Kedzie.
Timber: Oak, beech, maple, elm, cherry and sassafras.

Sand and silicates	85.37
Alumina	4.53
Oxide of iron	1.81
Lime	1.22
Magnesia	.59
Potash	.85
Soda	.37
Sulphuric acid	.23
Phosphoric acid	.30
Organic matter containing .16 nitrogen	3.14
Water	1.55

Capillary capacity for water, 39.60.

No. 8.—Clay Soil from Vineyard Agricultural College.

Selected by R. C. Kedzie.
Timber: Oak, maple, beech and elm.

Sand and silicates	65.48
Alumina	15.60
Oxide of iron	6.40
Lime	1.28
Magnesia	.89
Potash	2.12
Soda	1.16
Sulphuric acid	.25
Phosphoric acid	.41
Organic matter containin 11 nitrogen	4.10
Water	2.28

Capillary capacity for water, 59.15.

No. 9.—Loamy soil from field No. 8, Agricultural College.

Selected by R. C. Kedzie.
Timber: Oak, beech and maple.

Sand and silicates	74.65
Alumina	9.66
Oxide of iron	4.18
Lime	1.46
Magnesia	.43
Potash	1.97
Soda	1.13
Sulphuric acid	.26
Phosphoric acid	.31
Organic matter containing .12 nitrogen	4.66
Water	1.25

Capillary capacity for water, 43.50.

II. *Peach Belt.*

The conditions that determine the successful cultivation of the peach in our State are climatic to a large extent. Yet the peach thrives best, and produces fruit of finest quality on light, porous soils which are found in abundance along the eastern shore of Lake Michigan. Yet fruit of good quality is produced on some of the heavy clay lands found in this belt.

No. 10.—Peach belt soil, South Haven VanBuren Co.

Selected by A. S. Dyckman.
Timber: Hemlock.

Sand and Silicates	87.23
Alumina	2.87
Oxide of Iron	1.52
Lime	.51
Magnesia	.46
Potash	.83
Soda	.34
Sulphuric Acid	.20
Phosphoric Acid	.13
Organic matter containing .07 nitrogen	3.41
Water	2.23

Capillary capacity for water, 44.70.

No. 11.—Soil from Chase, Lake Co.

Selected by J. Brown.
Timber: Maple, Elm, Hemlock, Basswood, etc.

Sand and Silicates	87.32
Alumina	3.22
Oxide of Iron	2.10
Lime	.62
Magnesia	.28
Potash	.90
Soda	.63
Sulphuric Acid	.10
Phosphoric Acaid	.23
Organic matter containing .12 Nitrogen	3.78
Water	.55

Capillary capacity for water, 45.55.

No. 12.—Soil from Eden, Mason Co.

Selected by C. E. Resseguie.
Timber: Hemlock, intermixed with Hard Wood.

Sand and Silicates	92.43
Alumina	2.99
Oxide of Iron	1.23
Lime	.66
Magnesia	.12
Potash	.65
Soda	.23
Sulphuric Acid	.10
Phosphoric Acid	.22
Organic matter containing .03 Nitrogen	.87
Water	.27

Capillary capacity for water, 32.40.

No. 13.—Sandy Loam, Eden, Mason Co.

Selected by C. E. Resseguie.
Timber: Hardwood, mixed with Hemlock.

Sand and Silicates	75.27
Alumina	6.93
Oxide of Iron	6.10
Lime	1.00
Magnesia	.89
Potash	2.10
Soda	.90
Sulphuric Acid	.27
Phosphoric Acid	.30
Organic matter containing .09 Nitrogen	3.30
Water	2.92

Capillary capacity for water, 42.85.

No. 14.—Soil From Evart, Osceola Co.

Selected by F. York.
Timber: Hardwood, mixed with Pine and Hemlock.

Sand and silicates	83.80
Alumina	5.10
Oxide of iron	3.24
Lime	.80
Magnesia	.64
Potash	1.19
Soda	.52
Sulphuric acid	.12
Phosphoric acid	.29
Organic matter containing .07 Nitrogen	3.06
Water	1.24

Capillary capacity for water, 45.80

No. 15.—Pine Land, Colfax, Mecosta Co.

Selected by Fitch Phelps.
Timber: Heavy Pine Forest.

Sand and Silicates	75.54
Alumina	10.62
Oxide of iron	3.80
Lime	.94
Magnesia	.48
Potash	1.96
Soda	1.25
Sulphuric acid	.26
Phosphoric acid	.44
Organic matter containing .12 Nitrogen	2.97
Water	1.44

Capillary capacity for water, 45.40

No. 16.—Hardwood Lands, Big Rapids, Mecosta Co.

Selected by G. W. Warren.
Timber: Beech, Maple, Basswood.

Sand and silicates	76.00
Alumina	10.00
Oxide of iron	3.41
Lime	1.14
Magnesia	.49
Potash	1.80
Soda	1.16
Sulphuric acid	.24
Phosphoric acid	.33
Organic matter containing .10 Nitrogen	3.18
Water	1.90

Capillary capacity for water, 43.80.

No. 17.—Hardwood soil, Sherman, Wexford Co.

Selected by H. D. Griswold.
Timber: Maple, Rock-elm, Beech, Basswood and a little Hemlock.

Sand and silicates	86.74
Alumina	4.32
Oxide of iron	2.10
Lime	.65
Magnesia	.24
Potash	.83
Soda	.34
Sulphuric acid	.14
Phosphoric acid	.15
Organic matter containing .11 Nitrogen	3.26
Water	.86

Capillary capacity for water, 44.00.

No. 18.—Soil from Lake City, Missaukee Co.

Selected by L. A. Barker.
Timber: Beech, Maple, Elm and some Pine.

Sand and silicates	69.39
Alumina	8.35
Oxide of iron	5.80
Lime	1.15
Magnesia	.98
Potash	1.95
Soda	1.15
Sulphuric acid	.25
Phosphoric acid	.28
Organic matter, containing .11 nitrogen	4.73
Water	5.38

Capillary capacity for water, 39.10.

III. *The Potato District.*

Numbers 19 to 21 embrace several counties in the Traverse Bay region, where the soil is a sandy loam, rich in lime and potash. The fall of snow, caused by proximity to the lake, often comes before the ground is frozen, and root crops may be left in the ground all winter without injury. The porous nature of the soil, the abundance of lime and potash, and the climatic conditions all contribute to the production of potatoes of superior quality.

No. 19.—Potato Soil, Grand Traverse.

Selected by C. F. Davis,
Timber: Beech, Maple, Ash and Rock Elm.

Sand and silicates	88.65
Alumina	2.95
Oxide of iron	2.60
Lime	1.37
Magnesia	.41
Potash	.89
Soda	.32
Sulphuric acid	.14
Phosphoric acid	.13
Organic matter containing .04 nitrogen	2.05
Water	.49

Capillary capacity for water, 40.20.

No. 20.—Potato Soil, Benzonia, Benzie Co.

Selected by C. L. Northrop.
Timber: Beech, Maple, Ash, Elm, Cherry, etc.

Sand and silicates	90.08
Alumina	2.86
Oxide of iron	1.50
Lime	.55
Magnesia	.27
Potash	1.10
Soda	.45
Sulphuric acid	.18
Phosphoric acid	.21
Organic matter containing .07 nitrogen	2.45
Water	.35

Capillary capacity for water, 39.30.

No. 21.—Potato Soil, Elk Rapids, Antrim Co.

Selected by Geo. E. Steele.
Timber: Maple, Basswood, Elm, Beech and some Hemlock.

Sand and silicates	84.68
Alumina	4.82
Oxide of iron	3.20
Lime	.95
Magnesia	.36
Potash	.98
Soda	.40
Sulphuric acid	.16
Phosphoric acid	.18
Organic matter containing .08 nitrogen	3.14
Water	.65

Capillary capacity for water, 52.10.

IV. *Jack-Pine Plains. Nos. 22 to 25.*

In the northern central portion of the lower peninsula is a large tract of light sandy lands which have been called jack-pine lands, the barrens, the plains, etc. It is a light, sandy soil, of a brownish color from the presence of oxide of iron, very porous, and little retentive power for water. The principal timber is *pinus banksiana* (jack-pine), scarlet oak, with scattering trees of Norway pine and white pine. The subsoil seldom has any hard pan, and the water line in the soil is usually from fifteen to thirty feet below the surface of the soil.

The annual fires which sweep over these plains burn up the yearly accumulation of vegetable matter, and the soil contains very little humus. The small lakes have an abundant deposit of marl of good quality.

Some experiments have been made to ascertain the possibility of the use of these lands for agricultural or grazing purposes, on the experimental farm at Grayling, Crawford county. Three specimens of soil from this experimental farm are offered for inspection and one of marl from a lake near by. By comparing No. 22, the soil in its natural condition, only fenced in and protected from fire for three years, with Nos. 23 and 24 which have been culitvated and enriched by plowing under the green crops raised without manure (green manuring,) the changes in the physical appearance and in chemical composition can be observed. The north field (No. 23) has raised successive crops of spurry, vetch and peas, which have been plowed under. The south field (No. 24) has raised successive crops of spurry, peas and red clover, all plowed under.

No. 22.—Virgin soil from the experimental farm at Grayling.

Sand and Silicates	94.97
Alumina	1.03
Oxide of iron	.86
Lime	.20
Magnesia	.12
Potash	.20
Soda	.90
Sulphuric acid	.06
Phosphoric acid	.05
Organic matter containing .02 Nitrogen	1.61
Water	.23

No. 23.—North field of the experimental farm at Grayling.

Sand and silicates	94.30
Alumina	.61
Oxide of iron	1.17
Lime	.24
Magnesia	.17
Potash	.33
Soda	.58
Sulphuric acid	.05
Phosphoric acid	.04
Organic matter containing .05 Nitrogen	2.50
Water	.20

No. 24.—South field of the experimental farm at Grayling.

Sand and silicates	95.02
Alumina	.49
Oxide of iron	.78
Lime	.32
Magnesia	.15
Potash	.30
Soda	.62
Sulphuric acid	.05
Phosphoric acid	.01
Organic matter containing .04 nitrogen	2.25
Water	.21

No. 25.—Marl from the lake, Grayling.

Sand and silicates	1.90
Alumina	.14
Oxide of iron	.10
Lime	45.16
Magnesia	.32
Potash	.37
Soda	2.65
Sulphuric acid	.56
Phosphoric acid	.01
Carbonic acid	43.10
Organic matter containing .20 nitrogen	5.69
Water	.64

V. *Soils for special crops: Muck lands adapted to the growth of celery, cranberries, peppermint, etc. Nos. 26 to 28.*

Of all our kinds of soil, swamp muck has been most conspicuously held up to public opprobium. Nothing good was said about it; nothing too bad could be said against it. Yet for certain kinds of crops it was found the best land in the world, and the fame of Michigan celery has gone into every state.

No one who has tasted Kalamazoo celery will forget its fine flavor, which has established its reputation far and wide. Many will look to the composition of the soil on which it is grown as the typical one for raising celery.

No. 26.—Michigan celery soils: Kalamazoo celery soil from Kalamazoo, Michigan.

Selected by J. Dunkley.

Sand and silicates	19.16
Alumina	1.40
Oxide of iron	3.94
Lime	6.09
Magnesia	.81
Potash	.34
Soda	.38
Sulphuric acid	1.31
Phosphoric acid	.88
Carbonic acid	1.95
Organic matter containing 2.53 nitrogen	63.76
Water	6.51

Grand Haven has also become a center for the production of this delicious and appetizing plant. The extensive deposits of muck near the mouth of Grand river afford a large field for this plant.

No. 27.—Michigan celery soils: Grand Haven celery soil from Grand Haven. Mich.

Selected by George Hancock.

Sand and silicates	24.09
Alumina	1.71
Oxide of iron	3.52
Lime	5.02
Magnesia	.62
Potash	.20
Soda	.33
Sulphuric acid	1.04
Phosphoric acid	.69
Carbonic acid	1.05
Organic matter containing 2.32 nitrogen	61.73
Water	10.85

But celery soils are not limited to the lower peninsula. A choice specimen of celery muck was received from the Newberry Celery & Improvement Co., at Newberry, Luce county. Superintendent H. L. Harris writes: "On this soil we have produced the finest celery grown in the State. The celery grown here has a fine nutty flavor unknown to the celery grown in the southern part of the State. The soil is from sixteen feet to unknown depth, and there are thousands of acres of the same character of soil in our vicinity. We would also say that during the eight years we have been growing celery here we have not had a failure of crop."

No. 28.—Michigan celery soils: Newberry celery soil from Newberry, Luce Co., Mich.

Selected by H. L. Harris, superintendent of the Newberry Celery and Improvement Company.

Sand and silicates	21.56
Alumina	2.21
Oxide of iron	1.30
Lime	4.18
Magnesia	.75
Potash	.42
Soda	.40
Sulphuric acid	.67
Phosphoric acid	.46
Carbonic acid	1.10
Organic matter containing 1.75 nitrogen	63.75
Water	7.31

A comparison of these celery soils brings out the fact that, except in the amount of sand and silicates, the composition shows a close similarity. The common supposition that oxide of iron is especially injurious in celery soils is not borne out by these analyses. Sulphate of iron is very injurious, and when more than one per cent is present no valuable crop will grow. A specimen of muck was sent here from Decatur which was barren from this cause.

PROPERTIES OF GOOD MUCK.

In the moist condition, all these kinds of muck have a deep brown-black color, the blacker the better; they are friable, easily breaking between the fingers, and are free from coarse, fibrous material; they have a pleasant earthy smell but no acid odor, and are entirely free from acid reaction. When moist muck of good quality is pressed against blue litmus paper so as to wet the paper, the blue color remains and no reddening takes place. Any muck that will redden blue litmus is unfit for cultivation while this acid condition remains. Sour muck is sorry material for cultivation. All the specimens of infertile muck that have been sent here for analysis—muck that would not grow weeds even—have been of this sour class and would turn blue litmus paper red very rapidly. By draining and weathering such soils by exposing to the action of frost, and especially by the application of lime, wood ashes, even leached ashes, the acid condition can be removed and these barren soils made to produce abundant crops of a certain class.

OTHER MUCK CROPS.

Celery is not the only plant that can be profitably raised on muck lands. Cranberry farms have been made on the mucky soil near St. Joseph and cranberries of superior quality produced. But success with this crop requires a soil free from acid; patches of sterile muck are often found in parts of cranberry fields, but in every instance the muck was sour.

Another crop distinctive of Michigan cultivation is the peppermint. The center of peppermint farming and distilling the oil seems to be in St. Joseph county. A request was made for a specimen of the muck that produced such large crops of the mint but none came. Another letter was sent which brought the following reply: "Yours of March 11th received. Your first communication was referred to ——— ———, of this town, who is the largest mint raiser in the State, and who promised me he would forward the soil desired, but I saw him this morning and he said the ground was so frozen that he could not get it without being to greater expense than he wished to incur. The facts are that he does not want published to the world the benefits of reclaiming marsh land, for that is all there is in it. Any marsh land that can be drained so that it can be worked and still hold enough moisture to carry the crop through is good enough mint soil. * * * I could go twenty rods from my store and get marsh soil and send you but it would not be essentially different from what you could get on the Agricultural farm."

My modest friend, the mint grower, had "oil in his vessel," but was unwilling to "let his light shine before men." However, a college student brought a specimen of the mint muck, but too late for analysis and mounting to exhibit at the World's Fair. It does not differ in appearance and properties from the Kalamazoo celery muck, No. 26.

VI. *General Purpose Soils. Nos. 29 to 38.*

This embraces a number of soils found in the central and northern counties of the State, which are of too miscellaneous a character to be placed in a more restricted classification. They are inserted to round out the list of Michigan soils that have been analyzed at this college.

No. 29.—Gilmore, Isabella Co.

Selected by P. H. Robins.
Timber: Hardwood.

Sand and silicates	88.13
Alumina	3.77
Oxide of iron	2.40
Lime	.87
Magnesia	.27
Potash	.86
Soda	.37
Sulphuric acid	.16
Phosphoric acid	.19
Organic matter containing .08 nitrogen	2.35
Water	.52

Capillary capacity for water, 49.60.

No. 30.—Midland, Midland Co.

Selected by Gee. F. Ball.
Timber: Beech, maple, oak and basswood.

Sand and silicates	67.20
Alumina	6.31
Oxide of iron	7.91
Lime	1.64
Magnesia	1.23
Potash	1.85
Soda	1.15
Sulphuric acid	.30
Phosphoric acid	.49
Organic matter containing .22 nitrogen	5.30
Water	2.10

Capillary capacity for water, 51.15.

No. 31.—Sheridan, Clare Co.

Selected by J. C. Rockafellow.
Timber: Pine, hemloch, birch and maple.

Sand and Silicates	93.31
Alumina	2.03
Oxide of iron	1.40
Lime	.36
Magnesia	.16
Potash	.54
Soda	.26
Sulphuric acid	.08
Phosphoric acid	.15
Organic matter containing .03 Nitrogen	1.34
Water	.37

Capillary capacity for water, 43.10.

No. 32.—Grant, Clare Co.

Selected by J. C. Rockafellow.
Timber: Maple, beech, basswood, ash, oak, etc.

Sand and silicates	71.45
Alumina	6.50
Oxide of iron	7.18
Lime	.99
Magnesia	.73
Potash	1.90
Soda	1.20
Sulphuric acid	.19
Phosphoric acid	.36
Organic matter containing .16 Nitrogen	5.90
Water	3.70

Capillary capacity for water, 44.90.

No. 33.—Webber, Lake Co.

Selected by George W. Townsend. "The Plains."

Sand and Silicates	92.48
Alumina	2.22
Oxide of iron	1.59
Lime	.35
Magnesia	.30
Potash	.73
Soda	.32
Sulphuric acid	.06
Phosphoric acid	.14
Organic matter containing .04 Nitrogen	1.22
Water	.40

Capillary capacity for water, 35.30.

No. 34.—St. Louis, Gratiot Co.

Selected by S. S. Hastings.
Timber: Pine, Beech, Soft Maple, Oak and Sassafras.

Sand and silicates	88.54
Alumina	3.11
Oxide of iron	2.15
Lime	.68
Magnesia	.30
Potash	.92
Soda	.26
Sulphuric acid	.15
Phosphoric acid	.14
Organic matter containing .06 Nitrogen	2.82
Water	.41

Capillary capacity for water, 38.40.

No. 35.—Bay City, Bay Co.

Selected by Judge Marston.
Timber: Not stated.

Sand and silicates	82.24
Alumina	4.60
Oxide of iron	2.42
Lime	1.18
Magnesia	.46
Potash	1.18
Soda	.54
Sulphric acid	.20
Phosphoric acid	.38
Organic matter containing .17 nitrogen	5.57
Water	.25

Capillary capacity for water, 47.30.

No. 36.—Greenville, Montcalm Co.

Timber: Not stated.

Sand and silicates	85.40
Alumina	4.50
Oxide of iron	2.80
Lime	.82
Magnesia	.31
Potash	1.13
Soda	.45
Sulphuric acid	.21
Phosphoric acid	.20
Organic matter containing .10 nitrogen	2.75
Water	1.43

Capillary capacity for water, 37.80.

No. 37.—Gaylord, Otsego Co.

Selected by S. H. Crowl.
Timber: Maple, Beech, Hemlock, Basswood, etc.

Sand and silicates	91,92
Alumina	2.93
Oxide of iron	.90
Lime	.40
Magnesia	.13
Potash	.61
Soda	.28
Sulphuric acid	.10
Phosphoric acid	.14
Organic matter containing .07 nitrogen	2.20
Water	.39

Capillary capacity for water. 39.60.

No. 38.—Tawas, Iosco Co.

Selected by J. A. F. Scheffler.
Timber: Hemlock, Pine, Beech and Maple.

Sand and silicates	80.06
Alumina	7.15
Oxide of iron	3.53
Lime	.93
Magnesia	.36
Potash	1.10
Soda	.38
Sulphuric acid	.19
Phosphoric acid	.16
Organic matter containing .09 nitrogen	4.59
Water	.82

Capillary capacity for water, 63.80.

R. C. KEDZIE,
Chemist of Experiment Station.

AGRICULTURAL COLLEGE, MICH.,
July 2, 1893.

EIGHTY NEW STRAWBERRIES.

No. 100.—Horticultural Department.

For several years we have given considerable attention to the testing of varieties, both of fruits and vegetables, and we have about one hundred and fifty varieties of strawberries in our test plots, besides a duplicate collection at the South Haven sub-station.

We have had under trial, since the spring of 1892, some eighty new varieties, many of which were received from the originators for trial previous to dessemination and others were obtained from the introducers; very few of them have as yet been generally introduced.

When we could obtain them, twenty-five plants of a variety were grown in narrow matted rows set three and one-half by one and one-half feet. They received clean cultivation and were mulched during the winter. The soil upon which they were grown was a sandy loam with a slight admixture of clay, well enriched with stable manure. The plants in most cases made a satisfactory growth, and seemed quite free from disease until the crop began to ripen, when several varieties were attacked and, as noted below, the crop was greatly shortened.

In order that the originators and introducers may be informed of the behavior of their varieties in this section, and that the public may have information to guide them in the selection of varieties, the results of this season's trial are given in this preliminary bulletin. Later on we shall publish our regular strawberry bulletin and the report of the year's work at South Haven.

The letters after the names of the varieties indicate the sex of the plants "B" standing for bi-sexual, or perfect flowering, and "P" for pistillate.

Accomack. B.—Plants from Slaymaker & Son, Dover, Delaware. Plants of rather weak growth; leaf-stalk medium to long; leaflets, size, medium to large; form, irregular ovate; teeth, large; color, medium to light green. Blossomed full. Ripe, June 21. Plants bore fair amount of fruit for strength of plant. Fruit—size, medium; form, long conical; color, dark crimson; quality 9, firmness 7. Plants lack productiveness and vigor of growth. Considerable rust.

Alabama. B.—Plants from Slaymaker & Son: Plants of rather weak growth; leaf-stalk, long, slender; leaflets small to medium size, narrow ovate form; teeth, small, sharp; color, medium green. Blossomed full but did not set much fruit. Crop at best June 26. Fruit—size, medium; form, round conical; color, dark crimson; productiveness 5, quality 9, firmness 9.5. Plant lacks productiveness and vigor of growth. Considerable rust. Probably of no value.

Afton. P. Plants from C. W. Graham, Afton, N. Y. Plants of medium strong growth; leaf-stalk, long, slender; leaflets—medium size, narrow ovate form; teeth medium size, sharp; color, light green; texture, tough. Blossomed full and set a large amount of fruit. First ripe June 21. Crop at best June 24–26. Fruit, medium to large in size; form, round conical with short neck; color, very dark crimson; calyx persistent but berry picks easily; flesh dark; productiveness 9.5, quality 9, firmness 8.5.

Fruit of handsome appearance. One of the most promising sorts at the first of the season. The crop soon fell off rapidly. The plants rusted but little, but weakened in growth and did not mature the last fruits. Regard it as well worthy of further trial.

Beauty. B.—Plants from J. H. Haynes, Delphi, Ind. Plants medium strong in growth, leaf-stalk medium length, slender; leaflets medium size, round or ovate; teeth usually large, round; dark green color; thick in texture. Blossomed very full. First ripe June 21. Large amount of fruit. June 23 at best. Fruit stalk long and berries lie on ground. Fruit of large size, bright dark scarlet, round conical, or short, broad conical, sometimes quite irregular in form; productiveness, 9.5; quality, 8.5; firmness, 6; flesh, light.

Crop held out well in size and yield to close of season. Plant is productive and fairly vigorous, but berry lacks firmness and will only do for home use or local market.

Belle of Lacrosse. P.—Plants from W. F. Allen, Jr., Salisbury, Md. Plants medium strong growth, leaf-stalk usually short; leaflets medium size, ovate; teeth small, sharp; light green color; texture, papery. Blossomed full. First ripe June 21. Plants set a large amount of fruit. Crop at best June 26. Fruit, large; form, round conical or broad conical; color, bright dark scarlet; flesh, medium dark; productiveness, 9.5; quality, 8; firmness, 8.

Crop held out fairly well to the close of the season, though many of the later fruits were imperfect in shape. The plants rusted badly and are not likely to make a good stand for next season's fruiting.

Beverly. B.—Plants from Hale Bros., South Glastonbury, Conn. Plants of strong growth, leaf-stalk of medium length, stout; leaflets large, broad, ovate; teeth irregular; medium green color; texture, papery. Blossomed full. First ripe fruits June 21. Crop at best June 26. Fruit, large; round conical or long conical, sometimes slightly ridged; dark crimson color when fully ripe; productiveness, 8.5; quality, 9.5; firmness, 9.5.

Crop held out well in size and productiveness. Plants rusted but little. The fruit has the fault of not ripening at the tip. A promising berry for shipping purposes.

Bickle. P.—Plants from Prof. J. Troop, Purdue University, Ind. Plants are of medium strong growth; leaf-stalk usually short; leaflets, medium size, round, ovate; teeth, medium size, sharp; color, dark green; texture, tough. Blossomed full and set a moderate amount of fruit. First fruits ripe June 21. June 24–26, crop at best. Fruit small to medium in size; form, round conical; color, light scarlet; flesh, light; productiveness, 8.5; quality, 7; firmness, 7.

The berries are small, particularly after the first picking. The plants rust quite badly, and it seems to have nothing about it to recommend it.

Brunette. B.—Plants from G. Cowing, Muncie, Ind. Plants are of quite strong growth; leaf-stalk long, usually stout; leaflets large, broad, irregular ovate; teeth, large; medium to dark green in color. First fruits ripe June 21. Crop at best June 26. Fruits large, round conical, regular; very dark crimson color; seeds sunken; flesh dark; productiveness, 8; quality, 9.5; firmness, 9.

Berry very attractive in appearance and the plants are strong and healthy. It is scarcely up to the standard in productiveness, but its high quality will make it valuable for family use. Promising for further trial.

California. B.—Plants from Slaymaker & Son. Plants are not of strong growth; leaf-stalk short, stout; leaflets, small to medium size, round ovate; teeth, medium size, sharp; color, medium green; texture, papery. First ripe fruits June 24. Crop at best June 28. Fruit, medium to small in size; long conical, usually with short neck; color, bright dark scarlet; seeds, prominent; flesh, usually dark; productiveness, 4; quality, 9.5; firmness, 9.

Fruits are small. Plants are healthy, but lack vigor of growth and productiveness. Not worthy of a place on the list.

Cameronian. B. Plants from J. W. Cameron, East Rochester, Ohio. Plants of strong growth; leaf-stalk long, quite stout; leaflets, large, round ovate; dark green color, tough in texture; teeth large, rounded. First ripe fruits June 21. Crop at best June 26. Fruit of medium size, round conical, regular in form, light scarlet color; flesh, light; productiveness, 8; quality, 7; firmness, 7.

Plants are strong growing, but rust quite badly. Fruits held out well in size, but are light in color and calyx parts too easily. Scarcely worthy of a place among the more promising sorts.

Cheyenne. P.—Plants from Stayman & Black, Leavenworth, Kan. Plants are not strong growing; leaf-stalk short, quite stout; leaflets of medium size, nearly round; color, dark green; texture, papery; teeth small, sharp. First ripe fruits June 21. Crop at best June 26. Fruit of medium size, long conical, bright scarlet in color; flesh rather light; productiveness, 7; quality, 7; firmness, 7.

Plants are fairly healthy, and the crop held out well. Many of the berries were imperfect in form. Possesses points of medium merit only.

Clark's Early. B.—Plants from W. F. Allen, Jr. Plants of medium strong growth; leaf-stalk usually short; leaflets large, ovate or broad ovate; medium green color; texture, papery; teeth usually large. First ripe fruits June 19. Crop at best June 24. Fruit medium to large in size; round ovate; dark crimson color; flesh dark; productiveness 8.5, quality 9.8, firmness 9.

Plants remained healthy and crop held out well in size of fruit and productiveness. It is early. The fruit is attractive in appearance, firm, and of excellent quality. A very promising variety, particularly for family use. It will also be a good market sort.

Clark's Seedling, B—Plants from Cleveland Nursery Co., Rio Vista, Va. Plants of medium strong growth; leaf-stalk of medium length; leaflets medium to large in size; irregular; broad ovate; medium green color; texture papery; teeth irregular. First ripe fruits June 21. Crop at best June 26. Fruit medium to large in size; short, round conical form; color, dark crimson; flesh, dark; productiveness 3, quality 9.5, firmness 9.

Fairly good in plant growth. Berry of good quality, firm, and an excellent shipper. Lacks productiveness.

Clyde. B.—Plants from Stayman & Black. First received as Cycloma. Plants of very strong growth; leaf-stalk long, slender; leaflets usually small, ovate; color, medium green; texture, papery; teeth large, rounded. First ripe fruits June 21. Crop at best June 24–26. Fruit large to medium in size, round conical, or broad conical, bright dark scarlet color, flesh dark; productiveness 9.8, quality 8.5, firmness 9.2.

Plants remained healthy and crop held out well to close of season. The plants are productive and the berry firm. One of the most promising of the new varieties for market purposes.

Dayton. B.—Plants from Matthew Crawford, Cuyahoga Falls, Ohio. Plants strong growing; leaf-stalk medium, rather stout; leaflets large, round or ovate, dark green color, texture thick; teeth large, irregular. First ripe fruits June 21. Fruit small, long conical, often with neck; flesh light color; productiveness 3, quality 9, firmness 8.

Plants healthy and of vigorous growth, but bear little fruit. Owing to its lack of productiveness it is not a promising variety.

Dr. Moraire. B.—Plants from H. E. Van Deman, Washington, D. C. Plants of weak growth; leaf-stalk long, slender; leaflets small, narrow ovate; color, light green; texture, tough; teeth of medium size, shallow. First ripe fruits June 21. Fruit of medium size, round conical; color light scarlet; flesh light; productiveness 3, quality 5, firmness 7.

Plants are weak, rust badly and bear but little fruit. Of no merit.

Dutter. B.—Plants from Matthew Crawford. Plants of medium strong growth; leaf-stalk usually long, quite slender; leaflets large, broad ovate; medium to dark green color; texture papery; teeth large, shallow. First fruits ripe June 24. Crop at best June 27. Fruit large, round conical or long conical, somewhat irregular and ridged; color bright scarlet; flesh dark; productiveness 7.5, quality 9, firmness 8.5.

Crop ripens late and holds out well. Plants are healthy and quite vigorous, but scarcely productive or firm enough to be profitable as a market variety.

E. P. Roe. B.—Plants from Matthew Crawford. Plants of weak growth; leaf-stalk medium length, slender; leaflets of medium size, ovate or obovate; color, medium green; texture papery; teeth small, pointed. Fruit large, broad conical or long conical, usually with neck; color, scarlet; flesh light; productiveness 5, quality 8.5, firmness 8.

Lacks vigor of plant and productiveness.

Estelle. B.—Plants of very weak growth. Fruit imperfect. Seems to be worthless.

Fairmount. B.—Plants of strong growth; leaf-stalk long, slender; leaflets medium in size, ovate, color medium green; texture papery; teeth irregular. First ripe fruits June 21. Crop at best June 24–26. Fruit large, depressed conical, slightly ridged; color, dark crimson; flesh dark: productiveness 9.5, quality 9, firmness 7.5.

Plants are healthy and productive. The fruit is attractive in appearance and rather soft for shipment, but its productiveness and good quality make it valuable for home use.

Glenfield. B.—Plants from Stayman & Black. Plants strong growing; leaf-stalk long, slender; leaflets medium size, ovate; color, medium green; texture papery; teeth large, deep cut, sharp. First ripe fruits June 21.

Fruit of medium size, long conical, usually with neck; color, dark crimson; flesh dark; productiveness 5, quality 9, firmness 7.

The plants blossomed very full and set a large amount of fruit, but rusted so badly that the crop soon ran out. Its only hope is in thorough spraying.

Greenville. P.—Plants from E. M. Buechly, Greenville, Ohio. Plants of strong growth; leaf-stalk usually long, quite stout, but reclining; leaflets usually large, round ovate, turned up at edge, dark green, texture papery; teeth large, rounded. First ripe fruits June 21. Crop at best June 26–28. Fruit large, round conical or depressed conical, sometimes ridged; color, bright crimson; flesh dark; productiveness 9.5, quality 8, firmness 7.

The plants are strong growing, healthy and productive. The crop held out well to close of season. The fruit is lacking in firmness, otherwise excellent. A promising variety for use in a local market.

Gypsy. P.—Plants from Slaymaker & Son. Plants low growing but vigorous; leaf-stalk short; leaflets of medium size, ovate, dark green, texture thick and tough; teeth large, rounded. First ripe fruits June 21. Crop at best June 24. Fruit of medium size, round conical; color, dark crimson; flesh dark; productiveness 9, quality 9, firmness 9.

Plants remained healthy, but the crop did not hold out as well as it promised early in season. The fruit possesses excellent qualities and the variety is well worthy of further trial.

Harmon. B.—Plants from Slaymaker & Son. Plants of strong growth; leaf-stalk long, stout; leaflets large, usually broad ovate, medium green color, texture tough; teeth large, shallow. First ripe fruits June 21. Fruit large, round conical, often with short neck, color very dark, flesh dark; productiveness 4, quality 9.5; firmness 8.

Plants vigorous and healthy but lack productiveness.

Hattie Jones. P.—Plants from J. H. Haynes. Plants strong; leaf-stalk long, stout; leaflets large, broad ovate, color medium green, texture papery. First ripe fruits June 21. Crop at best June 26. Fruit medium to large in size, round conical or depressed conical, light scarlet color, flesh white; productiveness 9.5, quality 6, firmness 7.

Excellent in plant qualities and quite productive, but the fruit is light colored and lacking in flavor and firmness.

Hermit. B.—Plants from F. L. Piers, New Providence, Ind. Plants of strong growth; leaf-stalk long, slender; leaflets large, ovate; color dark green; texture thick; teeth regular. First ripe fruits June 21. Crop at best June 24. Fruit large, round conical, regular; bright crimson color; productiveness 8, quality 8, firmness 8.

Crop held out well and plants remained healthy to close of season. A variety of medium merit.

Huntsman. P. B.—Plants from W. A. Huntsman, Lawson, Mo. Plants of strong, vigorous growth; leaf-stalk long, stout; leaflets large, broad ovate, color dark green, texture tough. First ripe fruits June 21. Crop at best June 26. Fruit large, round conical, regular in form; color dark crimson; flesh dark; productiveness 8.5, quality 9, firmness 8.

Plants very strong and healthy; fairly productive. Crop held out well. Fruit attractive in appearance. Promising for home use or local market.

Hyslop. B.—Plants from Slaymaker & Son. Plants of medium strong growth; leaf-stalk very long, quite stout; leaflets large, ovate, medium green in color; texture papery; teeth large. First fruits ripe June 21.

Fruit small, imperfect. Plants are strong and healthy, but bear little fruit. Not promising.

Iowa Beauty. B.—Plants from J. T. Lovett Co., Little Silver, N. J. Plants of medium growth; leaf-stalk long, stout; leaflets large, round or broad ovate, color dark green, texture thick and tough; teeth large. First ripe fruits June 21. Crop at best June 26. Fruit large, round conical, color bright crimson, flesh dark; productiveness 7, quality 10, firmness 8.5.

Berry of excellent quality and holding out well in size to close of season. Plants of fair growth and healthy, but scarcely productive enough. Of medium merit.

Jones Seedling. B.—Plants from J. H. Haynes. Plants of medium strong growth; leaf-stalk short; leaflets medium to large in size, round ovate, medium green color, texture tough; teeth large, rounded. First ripe fruits June 21. Fruit large, short, depressed conical form, color dark crimson, flesh dark; productiveness 8.5, quality 9, firmness 8.5.

Plants are healthy and moderately vigorous. Fruit of handsome appearance and good quality. Holds out well. There are several varieties in the section. Possibly a mistake made by the sender of the plants, or by us in setting. The large majority of the plants are as above described.

Katie. B.—Plants from J. H. Haynes. Plants of strong growth; leaf stalk long, slender; leaflets large, broad ovate, medium to dark green color; texture papery; teeth large, pointed. First fruits ripe June 21. Crop at best June 26. Fruit medium to large in size, round conical or broad depressed conical; dull crimson color; flesh usually dark; productiveness 7, quality 8.5, firmness 7.5.

Plants strong and healthy, but not up to standard in productiveness. Medium merit.

Leader. B.—Plants from Matthew Crawford. Plants of fair growth; leaf-stalk of medium length, stout; leaflets of medium size, nearly round, color medium green, texture thick. First ripe fruits June 21. Crop at best June 24. Fruit large, long conical, bright dark crimson color, flesh dark; productiveness 8.5, quality 9.5, firmness 9.

Fruit attractive in form and color and firm. Plants quite productive but lack vigorous growth.

Leroy. P.—Plants from J. H. Haynes. Plants of strong growth; leaf-stalk of medium length, stout; leaflets medium size, narrow ovate, color dark green; texture papery; teeth large, pointed. First ripe fruits June 19. Crop at best June 24. Fruit large, depressed conical, sometimes ridged; color dark crimson; seeds prominent; flesh dark; productiveness 9; quality 8.5; firmness 8.

Plants are of vigorous growth and rust but little. The crop holds out well in size and productiveness. The fruit is not very firm but the seeds are prominent, making it a fairly good shipper. Early. Promising.

Leviathan. B.—Plants from Matthew Crawford. Plants of fair growth; leaf-stalk of medium length; leaflets medium size, round or ovate; color dark green; texture thick; teeth regular, sharp. First ripe fruits June 21. Crop at best June 24. Fruit large, broad depressed; color, light scarlet; flesh light; productiveness 8.5, quality 6, firmness 5.

Plants are healthy and crop holds out well in size. Berry is light colored and lacking in quality and firmness.

Lillie Monroe. B.—Plants of moderate growth; leaf-stalk long, stout; leaflets medium to large in size, round ovate; color medium green; texture tough; teeth rounded, shallow. First ripe fruits June 19. Crop at best June 24. Fruit large, depressed conical, ridged, dull dark scarlet color, flesh light; productiveness 5, quality 8, firmness 7.

Plants rusted badly at close of season. Not productive, and rather soft.

Lincoln. B.—Plants from Slaymaker & Son.

Plants of strong growth; leaf-stalk long, stout; leaflets large, ovate; color dark green; texture tough; teeth large, rounded. First ripe fruits June 21. Crop at best June 26. Fruit large, round conical, often with short neck; light scarlet color: flesh light; productiveness 9, quality 7, firmness 5.

Plants are strong, healthy and productive. Berry light in color and lacks firmness.

Magnate. P.—Plants from Stayman & Black. Plants moderately strong; leaf-stalk long, slender; leaflets large, ovate or obovate: color medium green; texture papery; teeth large, pointed. First fruits ripe June 22. Crop at best June 26. Fruit of medium size, long conical, bright scarlet color, flesh usually light; productiveness 6, quality 8, firmness 8.5.

Crop holds out well. Plants are healthy but not productive.

Mystic. B.—Plants from J. N. Haynes. Plants of strong growth; leaf-stalk medium to long, rather stout; leaflets medium to large in size, ovate, dark green in color, texture papery; teeth small, pointed. First ripe fruits June 26. Crop at best June 29. Fruit medium to large in size, round conical, bright dark crimson color, flesh usually light; prroductiveness 6, quality 9.5, firmness 9.

Plant strong, vigorous and rusts but little. Berry excellent in quality and firm. Plant lacks productiveness.

Neptune. P.—Plants from Henry Young, Ada, Ohio. Plants of strong growth: leaf-stalk long, stout: leaflets large, round or round ovate, color dark green, texture tough: teeth large. First ripe fruits June 23. Crop at best June 27. Fruit medium to large, round conical with short neck, slightly ridged: flesh light; productiveness 6, quality 7, firmness 5.

Plant very vigorous and healthy. Possesses no other points of excellence.

Nigger. B.—Plants from John Little. Plants of rather small growth: leaf-stalk long; leaflets medium to large in size, broad ovate; color medium green: texture tough: teeth large, rounded. First ripe fruit June 21. Crop at best June 24. Fruit small, round conical, dark crimson color: flesh dark; productiveness 6, quality 10, firmness 9.

Plants are of rather small growth, healthy, but not very productive. Fruit is small, of high quality, dark color and regular form. Not of special merit.

No. 1 (Allen). P.—Plants from W. F. Allen. Plants of fair growth: leaf-stalk medium to long, stout; leaflets medium to large in size, ovate; color, dark green; texture, papery; teeth, medium size, rounded. First ripe fruits June 22. Crop at best June 26. Fruit of medium size, round conical or long conical; bright crimson color; flesh, dark; productiveness, 9; quality, 9; firmness, 8.

Plants healthy, moderately vigorous, and productive. Crop held out well. Berry of attractive appearance and good quality. Promising.

No. 3 (Allen). B.—Plants from W. F. Allen. Plants of strong growht; leaf-stalk long; leaflets large, ovate; color, dark green; texture, papery; teeth, medium size, sharp. First fruits ripe June 23. Crop at best June

29. Fruit large, round conical, bright crimson; productiveness, 7.5; quality, 8.5; firmness, 7.

Plants are strong and healthy, but do not produce much fruit.

No. 3 (Belt). B. Plants from William Belt, Williamsburgh, Ohio. Plants of strong growth; leaf-stalk long, stout; leaflets large, broad ovate; color, medium to light green; texture, papery. First ripe fruits June 21. Crop at best June 26. Fruit large, round conical or broad conical; color, bright, light scarlet; flesh, medium in color; productiveness, 9; quality, 8; firmness, 8.

Promised well early in season, but plants weakened and rusted badly, and many berries did not mature.

No. 1 (Engle). B.—Plants from C. Engle, Paw Paw, Mich. Plants rather weak in growth. Fruit large, but irregular in shape, and produced only in small quantities. Not promising.

No. 2. (Feicht.) B.—Plants fron David Feicht, Little York, Ohio. Plants of strong growth; leaf-stalk usually long; leaflets of medium size, ovate; teeth sharp. First ripe fruits June 18. Crop at best June 24. Fruit medium to large in size; round conical; crimson color; flesh dark; productiveness 9.5, quality 8, firmness 8.5.

Plants strong and healthy. Crop ripened early and held out well. Its productiveness makes it promising for home use or local market.

No. 3. (Feicht.) P.—Plants from David Feicht. Plants of rather weak growth; leaf-stalk medium to long, rather stout; leaflets large, narrow ovate, edge turned toward center, medium green in color; texture, papery. First ripe fruits June 21. Crop at best June 26. Fruit large, irregular, ridged, conical; color, light crimson; productiveness 8, quality 7, firmness 9.

Plant rusted quite badly at close of season. Lacks vigor of plant growth.

No. 2. (Cameron.) B.—Plants from J. W. Cameron, East Rochester, Ohio. Plants of strong growth; leaf-stalk medium to long; leaflets medium to large, round ovate; color, dark green; texture, tough. First fruits ripe June 20. Crop at best June 24. Fruit of medium size, long conical, usually with neck; bright crimson color; seeds, prominent; flesh, dark; productiveness 8.5, quality 9, firmness 8.

Plants are healthy, strong growing and fairly productive. Berry of fine appearance, good quality and holds out well to close of season. Promising.

No. 6. (Cameron.) P. B.—Plants from J. W. Cameron. Plants of medium strong growth; leaf-stalk long, quite stout; leaflets large, ovate, medium to light green color; texture, papery. First fruits ripe June 22. Crop at best June 27. Fruit of medium size, round conical or broad conical; color, bright scarlet; flesh, dark; productiveness 4, quality 8.5, firmness 8.5.

Plants are healthy and fairly vigorous, but are not productive.

No. 13. (Cameron.) P.—Plants from J. W. Cameron. Plants not strong growing; leaf-stalk of medium length; leaflets small to medium in size, round ovate, color medium green; texture, tough; teeth small, sharp. First fruits ripe June 21. Crop at best June 26. Fruit of medium size, round conical, usually ridged; color, bright crimson; productiveness 8, quality 8, firmness 7.5.

Crop held out well in size of fruit to close of season. Plants lack vigor of growth, rust badly and do not produce many runners.

No. 31 (Haynes). P.—Plants from J. H. Haynes. Plants of very strong growth; leaf-stalk long, slender; leaflets of medium size, ovate;

color, light green; teeth irregular, sharp. First ripe fruits June 21. Crop at best June 26 Fruit of medium size, round conical, somewhat irregular form, bright scarlet color; flesh, light; productiveness 5, quality 6, firmness 6.

Plants rusted badly toward close of season. Crop did not hold out well. Not promising.

No. 18 (Little). B.—Plants from John Little, Granton, Ontario. Plants are not of strong growth; leaf-stalk medium to long; leaflets small, narrow-ovate; color, medium green; texture, tough. First ripe fruits June 18. Crop at best June 24-25. Fruit of medium size, round conical, bright dark crimson color, flesh dark; productiveness 8.5, quality 8, firmness 8.5.

Plants rusted badly toward close of season and could not mature crop. Lacking in plant growth and vigor.

No. 26 (Little). B.—Plants from John Little. Plants of medium growth; leaf-stalk long, quite stout; leaflets large, round ovate; color, medium green; texture, papery; teeth large, rounded. First ripe fruits June 21. Crop at best June 26. Fruit large, irregular, ridged; color, bright dark scarlet, flesh light; productiveness 9, quality 9, firmness 8.

Crop held out well in size, though the berry is irregular in shape. Plants are not of strong growth and rust toward close of season. Worthy of further trial.

No. 42 (Little). B.—Plants from John Little. Plants of medium growth; leaf-stalk medium to long; leaflets of medium size, ovate; color, medium to dark green; texture tough; teeth sharp. First ripe fruits June 21. Crop at best June 24–26. Fruit large, round conical, crimson color, flesh dark; productiveness 9, quality 9, firmness 8.

Crop held out fairly well. Fruit attractive in appearance and of good quality. Plant lacking in vigor of growth; rusts considerably. Of fair promise.

No. 3 (Stayman). B.—Plants from Stayman & Black. Plants of very strong growth; leaf-stalk usually long, stout; leaflets of medium size, narrow ovate; color medium green; texture papery; teeth sharp. First ripe fruits June 21. Crop at best June 24. Fruit of medium size, long conical; color dark crimson; flesh usually dark; productiveness 9.5, quality 7, firmness 8.5.

Plants are strong, healthy and productive. Crop held out well. The fruit has a stong acid flavor. Promising.

No. 2 (J. S.). B.—Plants are moderately vigorous and healthy. The fruit is large and of excellent quality. The plants are not productive.

No. 4 (J. S.). P.—Plants of moderately strong growth, healthy but not productive enough. Berry of attractive appearance and high quality.

No. 6 (J. S.). P.—Plants of stong growth; leaf-stalk of medium length and quite stout; leaflets medium size, ovate; color light green; texture tough; teeth sharp. First ripe fruits June 21. Crop at best June 26. Fruit large, round conical, ridged; color bright dark scarlet; productiveness 9.5, quality 7, firmness 6.

Plants rusted badly toward close of season. Berry rather soft. The plants are productive and the berry is attractive in appearance. It would be an excellent variety if the plants did not rust.

No. 34 (Thompson).—Plants from Cleveland Nursery Co. The plants are of medium strong growth. Fruit of medium size, round conical; color bright crimson; productiveness 5, quality 8, firmness 8.

Plants rust quite badly and are not productive. Berry parts from calyx easily, making it difficult to pick.

No. 77 (Thompson). B.—Plants from Cleveland Nursery Co. Plants of rather weak growth; leaf-stalk of medium length, slender; leaflets small to medium size, narrow ovate; color medium green; teeth irregular, pointed. First fruits ripe June 19. Crop at best June 23. Fruit small, long conical; color bright crimson; productiveness 9.5, quality 7, firmness, 5.

Plants lack vigor of growth; rusted badly at close of season. The fruit is small in size and lacks quality and firmness.

Odessa. P.—Plants from J. W. Cameron. Plants of medium strong growth; leaf-stalk long, quite stout; leaflets large, usually broad ovate; color, medium green; texture, papery; teeth large, rounded. First fruits ripe June 23. Crop at best June 27. Fruit large, irregular, ridged, bright scarlet, flesh light; productiveness 5, quality 7, firmness 7.

Plants of fair growth, rusted some toward close of season. Berry irregular in shape; does not ripen at tip. Not productive.

Ohio Monarch. B.—Plants of very strong growth; leaf-stalk long, quite stout; leaflets large, broad, ovate, color dark green, papery in texture; teeth large, sharp. First ripe fruits June 23. Crop at best June 27. Fruit very large, long, triangular, conical; color bright scarlet; flesh light.

Excellent in plant qualities. Berries large, but few of them.

Pawnee. B.—Plants from Stayman & Black. Plants of strong growth; leaf-stalk long, slender; leaflets of medium size, long, narrow ovate; color, medium green; texture tough. First ripe fruits June 19. Crop at best June 24. Fruit medium to large in size, round conical, usually with short neck; color, dark crimson; flesh dark; productiveness 7.5, quality 9.8, firmness 7.

Plants strong growing, but rusted at close of season. Berry attractive in appearance, and of high quality; not up to standard in productiveness, owing to the leaf rust. Had it not been for this it would have been among the best early sorts.

Primate. B.—Plants from Stayman & Black. Plants of strong growth; leaf-stalk, long, slender; leaflets of medium size, ovate; color, medium green; texture, tough; teeth, sharp. First fruits ripe June 21. Crop at best June 24. Fruit of medium size, long conical, often with short neck; bright dark crimson color; flesh dark; productiveness 6, quality 6, firmness 7.

Plants of strong growth but rusted quite badly. Crop soon gone. A large part of the later berries were small and did not mature. Not promising.

Smeltzer's Early. B.—Plants from Frank Smeltzer, Van Buren, Ark. Plants of strong growth; leaf-stalk very long, quite stout; leaflets large, ovate; color, medium to light green; texture tough. First ripe fruits June 19. Crop at best June 23–24. Fruit of medium size, round conical, or long conical; color, dark crimson; flesh dark; productiveness 8.5, quality 9, firmness 8.5.

Plants strong; a little rust at close of season. One of the earliest varieties to ripen the crop. Fruit of fair size, good quality and appearance. Promising as an early sort.

Standard. B.—Plants from G. H. & J. H. Hale. Plants of very steady growth: leaf-stalk of medium length, stout: leaflets large, broad ovate, color medium green, texture papery: teeth irregular. First fruits ripe June 21. Crop at best June 26. Fruit large, round conical, color bright dark crimson, flesh of medium color; productiveness 9, quality 9.5, firmness 7.

Plants weakened toward close of season and some rust appeared. Berry of regular form, handsome appearance and good quality: lacking in firmness. Productive. Promising for home use and local market.

Stevens. B.—Plants from Slaymaker & Son. Plants of strong growth; leaf-stalk long, slender; leaflets small, narrow ovate, medium to light green in color; texture papery; teeth small, sharp. First ripe fruits June 21. Crop at best June 24. Fruit of medium size, round conical, dark crimson color; flesh dark, productiveness 9, quality 9, firmness 8.

Crop held out well. A little rust on plants. Berry of fine appearance and good quality. Promising for near-by markets.

Southard. B.—Plants from G. H. & J. H. Hale. Plants of medium strong growth; leaf-stalk of medium length, stout; leaflets small to medium in size, narrow ovate, color medium green; texture papery; teeth small, sharp. First ripe fruits June 19. Crop at best June 24. Fruit large, round conical, bright scarlet color; flesh light; productiveness 8, quality 7, firmness 8.

This variety did not fulfill early promise, as the crop did not hold out well. Plants of fair growth and quite healthy, but many of the berries were small.

Surprise. B.—Plants from Slaymaker & Son. Plants of strong growth: leaf-stalk long, stout; leaflets medium to large in size, round or broad ovate; color medium to dark green; texture tough. First fruits ripe June 21. Crop at best June 26. Fruit of medium size, long conical, regular form, bright scarlet color; flesh dark; productiveness 6, quality 8, firmness 8.

Plants of good growth and healthy. Crop held out fairly well, but not enough of it. Nothing special to recommend it.

Swindle. P.—Plants from G. H. & J. H. Hale. Plants promised well early in season. Blossomed very full and set a large amount of fruit. Plants soon attacked with rust so badly that scarcely any fruit matured.

It seems to be of no value here unless thoroughly sprayed, but when free from rust it is an excellent shipper.

Tom Walker. P.—Plants from Albaugh Nursery Co., Tadmor, Ohio. Plants of very strong growth: leaf-stalk long, slender; leaflets vary much; teeth large, rounded. First fruits ripe June 21. Crop at best June 26. Fruit large, round conical; color dark crimson; flesh dark: productiveness 9, quality 8, firmness 8.

Plants strong and quite healthy. Berry of attractive appearance. Productive. Promising for home market purposes.

Westlawn. P.—Plants from C. P. Bauer, Judsonia, Ark. Plants are of medium strong growth and remained healthy. There were scarcely any fruits on plants, but it should not be condemned until after a second trial.

Weston. P.—Plant of strong growth: leaf-stalk long; leaflets medium to large in size, broad ovate; color, dark green: texture, thin but tough. First ripe fruits June 21. Crop at best June 24-27. Fruit large, broad conical, somewhat ridged, bright scarlet color; flesh, medium dark: productiveness, 9.8; quality, 8; firmness, 8.5.

Plants very strong and healthy. Crop held out best of any variety.

Berry of attractive appearance and fair quality, seeds prominent, making it a good shipper. One of the best varieties grown here this season.

Williams. B. Plants from Matthew Crawford. Plants of medium strong growth: leaf-stalk of medium length, slender; leaflets narrow ovate, medium green color, texture papery; teeth irregular, sharp. First ripe fruits June 21. Crop at best June 24. Fruit large, round conical or broad conical, dark crimson color, flesh dark, productiveness 8.5, quality 8.5, firmness 9.

Plants rusted badly toward close of season, and the crop did not hold out well on that account; had it not been for the rust it would have made a good showing as a shipping berry.

Yankee Doodle. P.—Plants from Geo. Q. Dow, North Epping, N. H. Plants of very strong growth; leaf-stalk varies in length; leaflets large, broad ovate; color dark green; texture tough. First ripe fruits June 21. Crop at best June 24. Fruit large to medium in size, round conical or depressed conical, bright scarlet color, flesh light; productiveness 9, quality 8, firmness 9.

Plants strong, healthy and productive. Crop held out fairly well. Promising as a market sort.

In the preceding notes many varieties are spoken of as promising except that plants rust badly. The Bordeaux mixture is an effectual remedy for this disease. Varieties, which under ordinary conditions rusted so much that but a small portion of the crop ripened properly, were sprayed in the fall, early in the spring and again after blossoming and were almost free from rust. So the fact that a variety, otherwise good, rusts badly is not so serious a fault as it would be did we not have so simple and effectual a remedy available as the Bordeaux mixture.

SUMMARY.

The following grouping shows, in a small space, our opinion of the varieties tested here the past season.

GROUP I.

Varieties possessing points of excellence superior to those of the average berry and which seem deserving of a place among the best sorts.

Clyde.
Greenville.
Leroy.
No. 1 (Allen).
No. 2 (Feicht).
No. 3 (Stayman).
Weston.
Yankee Doodle.

GROUP II.

Varieties having many points of merit but requiring a further trial to determine their place:

Afton.
Beauty.
Belle of Lacrosse.
Beverly.
Brunette.
Clark's Early.
Fairmount.
Gypsy.
Huntsman.
Leader.
No. 3 (Belt).
No. 2 (Cameron).
No. 26 (Little).
No. 6 (J. S.).
Pawnee.
Smeltzer's Early.
Standard.
Stevens.
Swindle.
Tom Walker.
Williams.

GROUP III.

Varieties possessing some good points, but of medium merit only:

Accomack.
Alabama.
Bickle.
Cameronian.
Cheyenne.
Clark's Seedling.
Dutter.
Glenfield.
Harmon.
Hattie Jones.
Hermit.
Iowa Beauty.
Leviathan.
Lillie Monroe
Lincoln.
Jones Seedling.
Katie.
Magnate.
Mystic.
Neptune.
No. 3 (Allen).
No. 3 (Feicht).
No. 6 (Cameron).
No. 13 (Cameron).
No. 4 (J. S.).
No. 34 (Thompson).
No. 77 (Thompson).
No. 18 (Little).
No. 42 (Little).
No. 2 (J. S.).
Odessa.
Ohio Monarch.
Primate.
Southard.
Surprise.
Westlawn.

GROUP IV.

Varieties having little or no merit:

California.
Dayton.
Dr. Moraire.
E. P. Roe.
Estelle.
Hyslop.
Nigger.
No. 1 (Engle).
No. 31 (Haynes).

The strawberries have been under the care of my assistant, Mr. H. P. Gladden, who has carefully noted the behavior of the plants and prepared the material for this bulletin.

L. R. TAFT.

AGRICULTURAL COLLEGE, MICH.,
August 10, 1893.

THE COLLEGE AT THE COLUMBIAN EXPOSITION.

The Michigan World's Fair Commission appropriated $3,000 towards the expenses of an exhibit from the college at the World's Fair. In consideration of this, the college undertook to prepare a large part of the agricultural exhibit of the State. This part of the exhibit was placed in the Agricultural Building. In the Horticultural Building the wax fruits prepared by Mrs. Stanley Potter attracted much attention. In the building of Manufacturers and Liberal Arts, in the educational division, were exhibited by the college from the mechanical, chemical and entomological departments as well as specimens of students' work in drawing, and photographs of college buildings and grounds. Four medals were awarded the college for excellence of exhibits.

The large and excellent forestry exhibit made by the State was presented to the college by the State World's Fair Commission and will be arranged in a museum which it is hoped will soon be provided by the legislature of the State.

Through the efforts of President I. M. Weston of the State World's Fair Commission several diplomas will be awarded to those who had charge of putting up exhibits and arranging them for exhibition.

Special mention is made of the collection of grains prepared by Prof. F. B. Mumford; of Michigan soils prepared by Dr. R. C. Kedzie; wax models of Michigan fruits and vegetables prepared under direction of Prof. L. R. Taft; collection of grasses by Dr. W. J. Beal; collection of insects by Prof. A. J. Cook and assistants; veterinary department skeletons and models prepared under direction of Dr. E. A. A. Grange, as well as exhibits of students' work in the mechanical department prepared under direction of Prof. L. P. Breckenridge and of drawing under Prof. W. S. Holdsworth.

The following is a description of the exhibits in the several departments:

AGRICULTURAL DEPARTMENT.

For some time past a large part of the experimental work in progress at the college has been performed by the students. This is true more especially of grains, roots, grasses, etc. Accordingly in the spring of 1891 the experiments were planned, with a view among other things, of making an exhibit at the World's Columbian Exposition in 1893.

The plan then was to combine the work for two seasons and to grow and save specimens and samples of all parts of all plants, which are representative of Michigan soils and climate. The seeds of those plants which were not already on hand were procured and the work commenced under the direction and supervision of the professor of Agriculture and his assistants.

For the purpose of growing these grains the 10 acres of ground previously used by the students for experimental purposes, was used. As was the practice previously, it was divided into plots, and only one variety grown on a plot. For the leading varieties, however, the plots were very much larger than the others and frequently in duplicate. This new object added new interest and so enthusiastic became the students and so successfully was the work carried on that at the end of the first season the results already obtained far exceeded the expectations of those in charge. Very careful notes were taken on all the plots from the time of the preparation of the ground until after the harvesting had been completed. These notes were taken at frequent intervals and in a general way contained the height, color, thickness, stool, diseases, etc. While these general notes were kept upon all the plots, more careful notes were taken along the line of the object of the experiment. Work of a similar nature was again conducted in 1892 and our exhibits were taken from the two seasons' growth.

The work of preparing the exhibit necessitated no small amount of diligent care and ingenious labor on the part of the students. To preserve the names of the varieties, care for during growth, harvesting, threshing, cleaning and preparing for exhibiting, hundreds of varieties of grains, was a task which in itself seemed nigh impossible. We are gratified to be able to say, however, that so faithfully was the work performed that we have yet to hear of a single mistake being made during the whole operation.

For the purpose of exhibiting the seeds and grains, glass jars and glass frames were procured. The glass jars purchased were plain cylindrical jars inverted, with the opening at the bottom, thus exposing as much clear surface as possible. They contained when filled about one pint of grain, and upon each was placed a neat label bearing the name of the variety and the season of growing.

The glass frames were 5x6x1 inches in size, with a glass front, the other part being made of oak, with the opening in the back. They were neat and proved to be an excellent method of exhibiting grains.

The object in preparing the straw samples was to show the natural length, size and color of the straw as well as the size and quality of the heads. The samples were stripped of their leaves and tied up in neat, compact bundles, about three inches in diameter, bearing as did the other samples, labels giving the name of the variety and the season of growing.

Upon the 500 square feet allotted to the college, convenient cases were erected with shelves for the inverted jars, sloping sides for the glass frames and standards to which the straw samples were fastened. When all had been put in place it presented a very showy and attractive appearance.

The exhibit included, aside from the straw samples, over four hundred samples of wheats, 150 being in inverted glass jars and the remaining 265 were placed in glass frames. Of oats there were exhibited 175 samples, 100 being in glass frames and 75 in inverted jars.

Of the straw samples there were about 400 specimens, 250 of these were wheats, 100 oats, and 50 of a miscellaneous nature such as grasses, millets, spurry, flax, etc.

A rare and most valuable part of the exhibit was that prepared by Dr. W. J. Beal, containing 30 specimens representing the forage plants, and 200 samples in which were represented the noxious weeds of Michigan and also the principal orders of plants.

Another very interesting part in the agricultural division was that prepared by Dr. R. C. Kedzie, containing 38 characteristic Michigan soils, mounted in show bottles, with a label bearing chemical analysis.

Forty-six samples of Clawson wheat cut at intervals of 24 hours, from time of blossoming to dead ripeness, mounted in show bottles with results of chemical analysis.

Forty-seven kinds of commercial fertilizers offered for sale in Michigan in 1893. Mounted in show bottles with results of chemical analysis.

Thirteen specimens of Indian corn raised in Michigan, and five specimens of feeding stuffs. All mounted in show bottles with results of chemical analysis.

The following varieties of corn were exhibited as the leading varieties of Michigan: Davenport, Holt, yellow dent, improved yellow dent, and Hathaway yellow dent.

The following were also present in the exhibit: Bird rape, dwarf Essex rape, millet, beans (6 boxes), Hungarian grass, sugar beet, mangel wurtzel, long red carrot, sorghum, broom corn, spurry, Japanese buckwheat, silver hull buckwheat and flaxseed.

In large jars or show bottles were placed grains as follows, representing the leading varieties of grains grown in Michigan: Wheat—White Clawson, Early Red Clawson, Jones Winter Fife, Diehl Mediterranean, Poole and Egyptian. Oats—American Banner, Clydesdale, Egyptian, White Wonder, Pringle's Progress and Yellow Prize Cluster.

The exhibits which were of especial interest and elicited most praise and comment, were the large number of specimens of wheat; there being over 300 varieties represented, the grasses, forage plants, weeds with seed and straw samples of each. Another very interesting exhibit was a sample of the roots of corn, intended to illustrate root growth the dirt having been washed away. Still another were the samples of wheat presented by the Detroit Board of Trade which had been graded by their inspector. But the curiosity which called out the most comment was a head of Clawson wheat, which was the result of one years selection. It was selected July 23, 1891 and was seven inches in length with eleven spikelets on each side. It is a remarkable instance of the results from careful selection.

At the close of the Fair the entire Michigan agricultural exhibit was taken down and shipped here to the Agricultural College to be placed in the agricultural museum.

HORTICULTURAL DEPARTMENT.

The exhibit of the horticultural department in the liberal arts building occupied 70 square feet and was intended to show the work of the students. It consisted of specimens of grafts of different kinds preserved in liquids in glass jars, also a variety of cuttings showing the formation of the callus and roots, drawings showing at full size, the operations of grafting, budding, layering and the propagation of plants from cuttings; drawings illustrating a variety of methods of constructing greenhouses, with details of the walls and roof, including the sash-bars, ridge and ventilators, as well as the making of hot-bed frames and sashes; a collection of the seeds of 125 varietis of garden vegetables, nearly all of which were grown and saved by the students. They were shown in flat boxes about seven by five inches and one inch deep and covered with glass, each sort being distinctly labeled. The department also showed a very complete assortment of garden and greenhouse hand tools, besides a variety of glazing implements, brads, etc., and a number of full sized sections of greenhouse sash-bars, both wooden and metallic. In the same case with the above were a number of plaster models of fruits and vegetables, made and colored by the students. In addition to the above which constituted the work of the junior class, there were some eighteen charts prepared by the seniors showing the appearance of various fungous diseases, particularly of the apple, pear plum, cherry, gooseberry, grape, potato, tomato, bean, rose and carnation. The drawings illustrated the microscopic structure of the diseases including the appearance of the mycelium, and of the summer and winter spores, as well as its appearance to the unaided eye. Accompanying the drawings were a number of fungicides in bottles, and in smaller bottles were the ingredients that were used in making them, each carefully labeled.

The examination papers of the juniors and seniors for the spring term's work in horticulture were shown as were those of the sophomores in a half terms work in landscape gardening.

Owing to the fact that an exhibit was not definitely decided upon until late in the fall term, and that the material was shipped before the middle of the spring term, it was not possible to prepare anything more than a partial exhibit of the work of the department.

Of the exhibits in the horticultural hall one of the most interesting was the collection of wax models of fruits and vegetables, exhibited by the horticultural department of the State agricultural college. By special arrangement with the college authorities, one-half of their cost was paid by the college and the other by the State commission, and at the close of the exposition they were to become the property of the college.

The models were fastened upon card board to the back wall of four cases each ten feet long, four feet high and one foot deep, the larger specimens being arranged upon a shelf near the bottom. The cases were of oak with glass in the front and in the top, and with plate glass mirrors in each end, and were placed back to back in pairs upon the upper shelf of the tables upon which the other fruit was displayed.

The collection contained 132 vairieties of apples of which seventeen had five specimens each shown upon plates, 23 of pears, 36 peaches, 32 plums, 16 cherries, 46 grapes, 13 currants, 8 gooseberries, 6 quinces, 10 raspberries, 9 blackberries, 55 strawberries, and 161 varieties of vegetables, including 19 of potatoes, 16 squashes, 14 cucumbers, 14 sweet corn, 14 radishes, 8 beets, 22 beans, 13 tomatoes, 7 melons, 6 onions, 9 peppers and 19 miscellaneous.

The originals from which the molds were made were furnished largely by the college, either from the fruit and vegetable garden at Lansing or its sub-station at South Haven, although many persons in various parts of the state, who were favored with fine fruit or vegetables, kindly contributed their choicest specimens. Among those who rendered aid in this way were J. N. Stearns, Kalamazoo; C. Engle, Paw Paw; Jos. Lannin, South Haven; L. B. Post, Lowell; J. B. Houk, Ludington; A. P. Green, Eaton Rapids; G. C. Reynolds, Inland; John Porter, W. S. Gebhart, Mears, and others. A large number of specimens, particularly of apples and plums were secured from the Wexford county exhibit at the West Michigan fair, and others were selected from the exhibits at the farmer's institutes at Benzonia and Traverse City.

Notable features of the exhibit were a number of fine seedling peaches originated by C. Engle of Paw Paw, and six seedling grapes from C. P. Chidester of Battle Creek.

The models were made at South Haven by Mrs. Stanley Potter (now of Farina, Ill.) who was granted a medal for the excellence of her work. The specimens used as models were carefully selected by some one at the college or by that well known pomologist, Hon. T. T. Lyon, and as most of the pieces were made in moulds from these, they are in size and shape excellent types of the varieties they represent. The coloring was so well done that they are very natural in appearance, even the bloom on the plums and grapes being present, and many persons who saw them did not suspect that they were wax until they noticed the sign.

By the use of these models it was possible to show during the entire exposition, correct representations of Michigan grown fruits and vegetables, many of which, such as peaches and strawberries, it was not possible to show in a fresh state for more than two weeks, even were the utmost pains taken to keep them renewed.

ENTOMOLOGICAL DEPARTMENT.

In the college exhibit the entomological department devoted the most of its space to cases of insects that were collected, named and labeled by seven different young men while students in the college. The largest of the seven collections occupied seventeen of the 56 cases and contained nearly 2,000 species of insects; the smallest filled three cases with about 300 species. The object of the collection was to show the method pursued in mounting and preparing collections by the students in their class work and by the size of the collections to show interest and zeal many of them manifest in doing so. The collection made a showy and attractive exhibit and was unique in that there was no other insect exhibit like it at the fair.

On either side above these cases of insects hung a frame containing cabinets of M. A. C. graduates who are at present interested in entomology or apiculture and have done special work in these branches. Among the older classmen comes Prof. Cook and Pres. Clute of our own college, Dr. Weed of the New Hampshire University, Prof. Gillette of the Colorado Agricultural College, Frank Benton of the Department at Washington and Prof. Bessey of the Nebraska University. Of the later graduates, A. B. Cordley of the Department at Washington, Prof. Hillman of the Nevada State University, Prof. Mayo of Kansas Agricultural College, C. B. Cook of Owosso, G. C. Davis at the M. A. C., H. E. Weed of the Mississippi Station, Prof. Aldrich of the Idaho State University and Prof. Niswander of Wyoming Agricultural College, form the second group.

At the side of the insect cases were several bottles of diluted and undiluted kerosene emulsion of both the Cook and Riley formulæ, showing by comparison the merits and demerits of the two as an insecticide.

In the Michigan forestry exhibit the entomological department placed nineteen cases of our most common and destructive insects on exhibit. Where the insects were not at hand, illustrations of the insects in the different stages of development were freely used and added much to the completeness of the list of forest insects. The collection also had a very complete system of labels so that the kind of tree on which it feeds and the part of the tree injured by it could be seen at a glance.

VETERINARY DEPARTMENT.

List of articles prepared by students and sent to the Columbian Exposition at Chicago, 1893. To wit: For the college exhibit:

One horse dissected and mounted in the standing position, showing the superficial muscles on one side and the deep seated ones on the other, also the parts affected in such diseases as Laminitis or Founder, Navicular disease or coffin joint lameness, bog spavin, curb. Sweeney, and many others.

One natural skeleton of the horse.
“ “ “ “ cow.
“ “ “ “ sheep.
“ “ “ “ hog.

A natural skeleton is one in which the bones are held together by their natural ligaments, and not by wires, or artificial ones, as is the case with the ordinary skeleton of commerce. To prepare the natural skeleton the bones have to be cleaned by manual labor, which requires much time and care, as well as a knowledge of anatomy to prevent injury or destruction of parts which should be left in tact. Ten models of horses mouths made in plaster paris were also prepared. These models were made from moulds taken from living animals whose ages were matters of record, and were for the purpose of showing the changes which take place in the teeth from one year old up to ten, a number of other models were also made from dead horses, which presented some peculiar feature that was interesting to reproduce for the purpose of illustration.

In addition to the above the department was asked to prepare a veterinary exhibit to be shown in the agricultural building in an alcove of the co-operative exhibit of the agricultural colleges and experiment stations of the United States, and for this purpose a second horse was dissected and prepared in similar manner to the one for our college display and the models of horses teeth were duplicated.

CHEMICAL DEPARTMENT.

List of Michigan soils exhibited by the chemical department of the M. A. C. at Columbian Fair, Chicago, 1893.

WHEAT SOILS.

1. Lenawee County, } River Raisin bottoms.
2. “ “
3. Burr Oak lands, Saline, Washtenaw County.
4. Prairie soil, } Cass County.
5. “ “
6. Midland, Midland County.
7. Garden soil,
8. Vineyard, } Agricultural College.
9. Field No. 8,

PEACH BELT.

10. South Haven,
11. Chase, Lake County,
12. Eden, Mason County. (Sand.)
13. Eden, Mason County. (Clay.)
14. Oscoda County.
15. Mecosta County.
16. Mecosta County.
17. Wexford County.
18. Lake City, Missaukee County.

POTATO DISTRICT.

19. Grand Traverse County.
20. Benzie County.
21. Antrim County.

JACK PINES PLAINS.

22. Natural soil from woods.
23. North field after spurry, vetch and peas.
24. South field after spurry, peas and clover.
25. Marl from the lake.

CELERY SOILS.

26. Muck from Kalamazoo.
27. Muck from Grand Haven.
28. Muck from Newberry.

CENTRAL BELT SOILS.

29. Isabella County.
30. Midland County.
31. Clare County, Sheridan.
32. Clare County, Grant.
33. Webber, Lake County.
34. St. Louis, Gratiot County.
35. Bay City.
36. Greenville, Montcalm County.
37. Gaylord, Otsego County.
38. Tawas, Iosco County.

Also 46 specimens of wheat cut at intervals of 24 hours, from time of flowering to dead ripeness, with analyses at the successive stages. Also analyses of the straw at the corresponding dates.

FOR STATE EXHIBIT.

The same set of mounted samples of Michigan soils, 38 in number, as was made in the educational exhibit.

Also 13 samples of Indian corn raised in different parts of the State, with analyses. Also four samples of mill stuffs, and mixed feed for stock, and two samples of material used to adulterate stock feed.

Also 46 samples of fertilizers offered for sale in Michigan during 1892, all mounted in show bottles and the results of analysis given for each as determined at the chemical laboratory at M. A. C.

BOTANICAL DEPARTMENT.

Owing to the late date at which the State World's Fair Commission decided to assist the college in making an exhibit much valuable time for collecting specimens for the botanical exhibit was lost. It was not until Sept. 1892 that work was begun. This will account for a lack in some directions that might have been avoided had more time been given.

It was also decided to divide the exhibit which tended to lessen its efficiency at least in general appearance.

EXHIBIT IN THE AGRICULTURAL DEPARTMENT.

This was rendered possible by the fact that we happened to have on hand some things formerly collected. This part consisted in:

Twenty-seven bundles of grasses and other forage plants, each ten inches in diameter. They were grown on plats carefully weeded of all other plants. The soil was a stiff clay, well drained. The average yield when dry, per rod, per year, of three square rods, for 1891–1892 is given in nearly every case below.

Agropyrum caninum, R. and S. Tall wheat grass, a slender variety. This wild grass is found in Michigan on dry soil and seems to promise well to employ in mixtures for meadows.

Agropyrum repens, L. Couch, Quick or Quack Grass. A grass from Europe, now too often found in meadows and cultivated fields. Good for fodder, but difficult to exterminate. One of our worst weeds.

Agropyrum tenerum, Vasey. Slender wheat grass. Apparently promising for meadows to mix with clovers or other grasses. A new thing worth trying. Native of N. A., west of Mississippi. Average yield per sq. rod, 36.89 lbs.

Agrostis alba, L. Red Top. Herd's grass. A perennial with root stocks, flowering rather late. One of the best known and most valuable grasses for river bottoms either for grazing or for mowing. Native of Europe. Average yield, 19.37 lbs.

Alopecurus pratensis, L. Meadow Foxtail. Early, nutritious, suitable for meadow or pasture in damp climates. Much grown in Great Britain; of much less value in most parts of the United States. Native of Europe.

Anthoxanthum odoratum, L. Sweet Vernal Grass. A fragrant grass from Europe· Much grown in pastures and lawns where the soil and climate are moist.

Arrhenatherum avenaceum, Beauv. Tall Oat Grass. A tall, rapidly growing, early perennial; in many places highly prized for pasture or meadow. It is well to mix with red clover and orchard grass. Native of Europe. Average yield, 16.50 lbs.

Calamagrostis Canadensis, Beauv. Blue Joint. A rather course marsh grass, of good quality when cut early.

Dactylis glomerata, L. Orchard Grass. Cock's Foot. Valuable for pasture or for mowing in good soil. It must be cut or fed early to prevent seeding. Much grown in Great Britain and on the continent of Europe. Native of Europe. Av. yield 31.50 lbs.

Elymus Europeus, L. A kind of Rye Grass. Coarse and unprofitable in most places. A native of Europe.

Festuca elatior, L. var. *Arundinacea*, Haeck. Taller Meadow Fescue. A large perennial of promise for pasture or hay, when grown by itself, or better when mixed with other grasses and clovers. This particular variety is not in the market. Native of Europe. Av. yield, 53.12 lbs.

Festuca pratensis, L. Meadow Fescue. A perennial grass valuable to sow in mixtures for meadow or pasture in a moist climate. Native of Europe. Av. yield, 15 lbs.

Glyceria Canadensis, Trin. Rattlesnake Grass. A low land grass of little economic value. Rather ornamental.

Holcus lanatus, L. Velvet Grass. A grass from Europe, often found in moist meadows. Quality inferior.

Hordeum jubatum, L. Squirrel tail Grass. Somewhat ornamental; of little value for forage.

Lolium perenne, L. Perennial Rye Grass. A nutritious and very rapidly starting grass. The most used of any in Great Britain. Not a favorite in the United States. Introduced from Europe.

Medicago sativa, L. Lucerne. Alfalfa. Very valuable for mowing in dry, warm climates. In moist countries, grasses and weeds soon crowd it out. Native of Europe. Av. yield, 36 lbs.

Phalaris arundinacea, L. Reed Canary Grass. A coarse marsh grass of rapid growth. In cultivation it thrives on any rich land. Suitable for meadow or pasture. Our ribbon grass with striped leaves is a variety of this grass. Native of North America.

Phleum pratense, L. Timothy. Herd's Grass. The best known and most used of the grasses, especially valuable for hay on clay or loamy soil. Introduced from Europe. Av. yield, 54.91 lbs.

Phragmites communis, Trin. Reed Grass. One of our largest native marsh grasses. Of little value.

Poa compressa, L. Blue Grass. Wire Grass. A rather late perennial; very nutritious and heavy for its bulk, thriving best on clay land. Seldom purposely sown, though deserving of attention. Native of Europe.

Poa nemoralis, L. Wood Meadow Grass. A native of both hemispheres. Much grown in Europe for meadow and pasture.

Poa pratensis, L. June Grass. Kentucky Blue Grass. Extensively distributed and well known for pasture and lawn. Native of Europe. Av. yield, 28.33 lbs.

Poa serotina, Ehrh. Fowl Meadow Grass. Very valuable for one crop per year of good hay when grown on wet or moist land. Not suitable for pasture. It is well to mix with red top. Native of N. A. Av. yield, 50.83.

Spartina cynosuroides, Willd. Fresh-water Cord Grass. Grown on banks of rivers and lakes. Stems and leaves very tough.

Trifolium hybridum, L. Alsike Clover. A forage plant from Europe sometimes grown in moist soil. Its success is usually uncertain. Stems weak. Flowers good for honey bees.

Trifolium pratense, L. Early Red Clover. A forage plant from Europe, much grown in temperate climates.

Seeds of grasses, other forage plants and lawn grass seed mixtures, (207) two hundred and seven species. The seeds were exhibited in shallow boxes with light white-ash frames or margins, and a flat glass cover. Each box about five by seven inches. A few were purchased; most were raised at the college.

The following is the list:
Agropyrum caninum, R. & S. Erect form. Bearded Wheat Grass.
“ “ Weak form. Bearded Wheat Grass.
“ *dasystachyum*, Vasey.
“ *divergens*, Nees. Wire Bunch grass.
“ *glaucum*, R. & S. Wild Quack grass. Blue Stem.
“ *japonicum*, Vasey.
“ *repens*, Beauv. Couch, quirk or quack grass.
“ *tenerum*, Vasey.
“ *unilaterale*, V. & S.
“ *unilaterale, var. glaucum.*
Agrostis agrestis.
“ *alba*, L. Red top.
“ *canina*, L. Bent-Grass.
“ *dispar*, Michx. Southern Bent.
“ *pulchella.*
“ *scabra*, Willd. Haïr-grass.
“ *vulgaris*, With. Small Red Top.
Bouteloua oligostachya, Torr. Blue Grama. Mesquit g.
“ *racemosa*, Lag. Tall Grama. Hairy Mesquit g.
Briza maxima, L. Large Quaking-grass.

Brizopyrum siculum.
Bromus arvensis, L. Chess.
" *breviaristatus*, Thurber. Short-awned Brome g.
" *brizæformis*, Fisch. Quaking-grass.
" *ciliatus*, L. Swamp Chess.
" *inermis*, Awnless Brome-Grass.
" *kalmii*, Gray. Wild Chess.
" *mollis*, L. Soft Chess.
" *pumpellianus*, Scrib.
" *secalinus*, L. Chess. Cheat.
" *unioloides*, Willd. Schrader's Brome.
Cenchrus catharticus, Del. Sand-bur.
" *tribuloides*, L. Sand-bur.
Chloris barbata.
" *truncata*, R. Br.
" *virgata.*
Cinna arundinacea, L. Wood Reed-grass.
Coix lachryma, L. Job's tears.
Cynodon dactylon, Pers. Bermuda Grass.
Cynosurus cristatus, L. Crested Dog's-tail grass.
Alopecurus pratensis, L. Meadow Foxtail.
Andropogon argenteus.
" *furcatus*, Michx. Finger grass. Turkey-foot.
" *hallii*, Hack. Turkey-foot.
" *scoparius*, Michx. Little Blue stem. Broom Sedge.
Anthistiria avenacea.
" *ciliata.*
Anthoxanthum odoratum, L. Sweet vernal-grass.
" " *var puellii*, Sweet vernal-grass.
Apera spica-venti, Beauv.
Aristida depressa, Retz.
Arrhenatherum avenaceum, Beauv. Tall oat grass.
Arundinella anomala.
Asprella hystrix, Willd. Bottle grass.
Avena flavescens, L. Yellow oat-grass.
" *sterilis*, L. Animated oats.
" *striata*, Michx. Oat-grass.
Beckmannia erucæformis, Host. Slough-grass.
Dactylis glomerata, L. Orchard grass. Cock's foot.
" " seeds selected from a type Cock's foot.
Danthonia spicata, Beauv. Old fog.
Deschampsia cæspitosa, Beauv. Tufted hair-grass.
" *calycina*, Resl.
" *cuspidata.*
" *flexuosa*, Griseb. Hair-grass.
Deyeuxia canadensis, Hook. Blue-joint.
Diarrhena americana, Beauv. Twin-grass.
Eatonia pennsylvanica, Gray. Eaton's-grass.
Eleusine coracana.
" *flagellifera*, Nees.
" *indica*, Gærtn. Goose-grass.
" *scindica.*
Elymus americanus. Vasey.
" *arenarius*, L. Lyme grass.
" *canadensis*, L. Wild Rye.
" " var. *glaucifolius*, Wild Ryne.
" *condensatus*, Presl. Giant rye-grass.
" *europæus.*
" *striatus*, Willd. Smaller wild rye.
" *virginicus*, L. Wild rye grass.
" " var. *glaucus*, Beal.
" sp.?
Eragrostis abyssinica.
" *elegans.*
" *frankii*, Meyer. Short-stalked meadow-grass.
" *major*, Host. Stink-grass.
" *suaveolens.*

Erianthus ravennæ.
Eriochloa annulata, Kth.
“ *aristata*, Vasey.
“ *punctata*, Hamil.
Euchlæna luxurians, Teosinte.
Festuca elatior, var. *arundinacea*. Tall Fescue.
“ *glauca* (?)
“ *nutans*, Willd. Nodding Fescue.
“ *ovina*, var. *capillata*. Sheep's Fescue.
“ “ “ *duriuscula*. “ “
“ “ “ *marginata*. “ “
“ *remotiflora*.
“ *tenella*, Willd. Slender Fescue.
“ *sp.* (?)
Glyceria canadensis, Trin. Rattlesnake grass.
“ *grandis*, Watson. Reed meadow grass.
Holcus lanatus, L. Velvet-grass.
Hordeum distichon, L. Two-rowed barley.
“ *hexastichon*, L. Six-rowed barley.
“ *jubatum*, L. Squirrel-tail grass.
Kœleria cristata, Pers. Wild June-grass.
Lagurus ovatus.
Leersia lenticularis, Michx. Catch-fly grass.
Lolium perenne, L. Perennial rye-grass.
“ “ var. *italicum*. Italian rye-grass.
Milium effusum, L. Wild millet-grass.
Oryza sativa, L. Rice.
Oryzopsis melanocarpa, Muhl. Black-fruited mountain rice.
Panicum capillare, L. Old-Witch-grass.
“ *crus-gilli*, L. Barnyard-grass.
“ *gibbum*.
“ *italicum*, var. *præcox*.
“ *miliaceum*, L. Millet.
“ “ var. “
“ “ var. “
“ “ var. “
“ *sanquinale*, L. Crab-grass. Finger grass.
“ *teneriffæ*.
“ *texanum*, Buckl. Texas millet.
“ *virgatum*, L. Switch-grass.
Paspalum dilatatum, Poir.
“ *paniculatum*, L.
Pennisetum cenchroides.
“ *spicatum*. Pearl millet.
Phalaris arundinacea, L. Reed-canary-grass.
“ *canariensis*, L. Canary-grass.
Phleum pratense, L. Timothy.
Poa arachnifera, Torr. Texas blue-grass.
“ *compressa*, L. Blue-grass.
“ *nemoralis*, L. Meadow grass.
“ *nevadensis*, Vasey.
“ *pratensis*, L. June grass. Kentucky blue-grass.
“ “ var. magna. June grass. Ketucky blue-grass.
“ “ var. minor. “ “ “
“ *trivialis*, L. Rough meadow grass.
Secale cereale, L. Rye.
Setaria germanica. German Millet. Hungarian-grass.
“ *glauca*, Beauv. Yellow Fox-tail.
“ *italica*, Kth. Italian Millet.
“ “ var. (?) “ “
“ “ var. (?) “ “
“ *viridis*, Beauv. Green Fox-tail.
Sorghum halapense, Pers. Johnson grass.
“ *vulgare*, Pers. Sorghum. Broom corn, etc.
“ “ var. Milo Maize.
“ “ var. (?)

Spartina cynosuroides, Willd. Cord-grass.
Stipa pennata L. Feather grass.
" *spartea, Trin.* Porcupine grass.
Tragus racemosus, Hall.
Trisetum cernuum, Trin.
Triticum villosum.
" *sativum,* L. Wheat.
Uniola latifolia, Michx. Broad-leaved Spike-grass.
Zea mays, L. Indian Corn. Maize.
Zizania aquatica, L. Indian Rice. Wild Rice.

OTHER FORAGE PLANTS.

Achillea millefolium, L. Yarrow. Milfoil.
Anthyllis vulneraria, L. Kidney Vetch.
Astragalus lotoides.
Dolichos chinesis. Cow Pea.
" " var. "
" " var. "
" " var. "
" " var. "
Erodium cicutarium, L'Her. Storkbill. Alfillaria.
Galega officinalis.
Lathyrus sativus. Chick Pea.
Lens esculenta. Lentils.
Lespedeza sericea.
" *striata.*
Lupinus albus.
" *hirsutus.*
" *luteus.*
Medicago lupulina, L. Black Medick.
" *sativa,* L. Lucerne. Alfalfa.
Melilotus alba Lam. Melilot. Sweet clover.
Onobrychis sativa. Sainfoin.
Plantago lancelota, L. Rib-grass. Narrow-leaved Plantain.
Soja hispida. Soja Bean.
Spergula arvensis, L. Spurry.
Trifolium arvense, L. Hare's-foot Trefoil.
" *hybridum,* L. Alsike clover.
" *medium,* L. Mammoth clover.
" *pratensis,* L. Early red clover.
" *procumbens,* L. Hop Trefoil.
" *repens,* L. White clover. Shamrock.
" *sp.* Suckling clover.

MIXTURES OF SEEDS FOR LAWN.

Henderson's. Composed of creeping Bent, Timothy, Sweet Vernal, Sheep's Fescue. Perennial Rye Grass, June Grass, White Clover, Red Top; free from seeds of weeds and large clover.

Henderson's Terrace Sod Mixture. Composed of Sheep's Fescue, Crested Dogstail Red Top, June Grass, White Clover, Perennial Rye Grass, *Juncus tenuis,* Sweet Vernal, Creeping Bent; a large proportion of fescues and red top.

Vaughan's. Composed of June Grass, White Clover, Finger Grass, *Juncus tenuis,* Red Top, Timothy, Ergot; mainly June grass and red top; quite free from dirt.

Landreth's. Composed of June Grass, Perennial Rye Grass, White Clover, Fowl Meadow Grass; very free from dirt and seeds of weeds.

Ferry's Fine Mixed. Composed of June Grass, Red Top, White Clover, Timothy, Old Witch Grass; dirt and chaff abundant; seeds of weeds few.

Gardner's Special Evergreen No. 27. Composed of June Grass, Perennial Rye Grass, Crested Dogstail, Sweet Vernal, Red Top, White Clover, Barnyard Grass, Fescue, Sorrel, Finger Grass, Ergot, Velvet Grass, Timothy, Sheep's Fescue; much dirt and chaff.

Central Park Mixture of D. M. Ferry & Co. Composed of Sheep's Fescue, Darnel, June Grass, Fowl Meadow Grass, White Clover, Sweet Vernal, Velvet Grass, Hair Grass, Medick, Hawkweed, Chaff.

ROOTS OF FOUR PLANTS OF INDIAN CORN

washed from the soil. Some passed through a hole in a pebble, others for a foot went through a dead root of a tree; the longest was five feet. Grown on poor, light land.

EXHIBIT IN THE HALL OF MANUFACTURES AND LIBERAL ARTS MADE BY THE BOTANICAL DEPARTMENT.

Thirty-one specimens of grasses and other forage plants at full length, dried under pressure and mounted on heavy paper two feet wide and from two to eleven feet long, as follows:

Agropyrum caninum, R. and S. Tall Wheat Grass. A rather slender grass with weak stems. Of some promise to use in mixtures for meadows. Native of Rocky Mountains.

Agropyrum caninum, R. and S. Tall Wheat Grass. This wild grass found in Michigan on dry soil, seems to promise well to employ in mixtures for meadows.

Agropyrum repens, L. Quick or Couch Grass. Of fair value for meadow or pasture. It seldom seeds, but spreads rapidly by its numerous root stocks. One of our very worst weeds. To kill: Plow shallow in fall or early spring and cultivate every three days, or often enough to prevent the appearance of green leaves. Native of Europe.

Agropyrum tenerum, Vasey. Slender Wheat Grass. Apparently promising for meadows to mix with clovers or other grasses. A new thing worth trying. Native of North America west of Mississippi.

Agropyrum unilaterale, V. and S. One-sided Wheat Grass. Of some promise to mix with clovers or other grasses for meadows. Native of North America west of the Mississippi.

Agrostis alba, L. Red Top. Herd's Grass. A perennial with root stocks, flowering rather late. One of the best known and most valuable grasses for river bottoms either for grazing or for mowing. Native of Europe.

Alopecurus pratensis, L. Meadow Foxtail. Early, nutritious, suitable for meadow or pasture in damp climates. Much grown in Great Britain; of much less value in most parts of the United States. Native of Europe.

Arrhenatherum avenaceum, Beauv. Tall Oat-grass. A tall, rapidly growing, early perennial; in many places highly prized for pasture or meadow. It is well to mix with red clover and orchard grass. Native of Europe.

Cynodon dactylon, Pers. Bermuda Grass. Thriving in hot climates and spreading rapidly by stout root stocks. Of good quality for hay or pasture; suitable for a lawn in warm climates. Apparently of little value in the northern states. Found in warm countries.

Dactylis glomerata, L. Orchard Grass. Cock's Foot. Valuable for pasture or for mowing in good soil. It must be cut or fed early to prevent seeding. Much grown in Great Britain and on the continent of Europe. Native of Europe.

Eleusine coracana, Gaertn. This annual grass is a native of India, where it is grown on light soils. The yield of seeds is large, much resembling those of millet.

Elymus virginicus, L Wild Rye, Lyme-grass. A stout perennial, not thought to be of great value. Shown here for comparison with a larger variety. Native of U. S.

Elymus virginicus L. var. *glaucus*. Glaucous Lyme-grass. Raised from seeds of one selected plant. This variety is larger than the species which grew near it. Native of Michigan.

Festuca elatior, L. var. *arundinacea*, H. Taller Meadow Fescue. A large perennial of promise for pasture or hay, when grown by itself, or better when mixed with other grasses and clovers. This particular variety is not in the market. Native of Europe.

Festuca pratensis, L. Meadow Fescue. A perennial grass valuable to sow in mixtures for meadow or pasture in a moist climate. Native of Europe.

Lolium perenne, L. Perennial Rye-grass. A nutritious and very rapidly starting grass. The most used of any in Great Britain. Not a favorite in the United States. Introduced from Europe.

Medicago lupulina, L. Black Medick. A leguminous plant, useful for pasture on moist clay land, especially when mixed with other plants. Native of Europe.

Medicago sativa, L. Lucerne. Alfalfa. Very valuable for mowing in dry, warm climates. In moist countries grasses and weeds soon crowd it out. Native of Europe.

Onobrychis sativa, Lam. Sainfoin. A leguminous forage plant, much grown in some portions of Europe; not usually profitable in this country. Native of Europe.

Panicum miliaceum, L. Indian or Common Millet. An annual grass sometimes sown in this country for seeds or for fodder. Much grown in India.

Phalaris arundinacea, L. Reed Canary Grass. A coarse marsh grass of rapid growth. In cultivation it thrives on any rich land suitable for meadow or pasture. Our ribbon grass with striped leaves is a variety of this grass. Native of North America.

Phleum pratense, L. Timothy. Herd's-grass. The best known and most used of the grasses, especially valuable for hay on clay or loamy soil. Introduced from Europe.

Poa compressa, L. Blue Grass. Wire Grass. A rather late perennial; very nutritious and heavy for its bulk, thriving best on clay land. Seldom purposely sown, though deserving of attention. Native of Europe.

Poa nemoralis, L. Wood-meadow Grass. Much like the [more common June Grass (*Poa pratensis*, L.) and perhaps rather better. It has no root stocks and in the United States is soon crowded out by other grasses. Native of Europe.

Poa pratensis, L. June Grass. Kentucky Blue Grass. A mixed lot of larger and smaller plants. Extensively distributed and well known for pasture and lawn. The cultivated forms are from Europe.

Poa pratensis, L. var. *magna*, Beal. Large June Grass. A large "strain" of June grass or Kentucky Blue Grass, procured by the selection of one plant. Especially valuable for pasture. Native of Europe and North America.

Poa serotina, Ehrh. Fowl Meadow-grass. Very valuable for one crop per year of good hay, when grown on wet or moist land. Not suitable for pasture. It is well to mix with Red Top. Native of North America.

Sorghum halapense. Johnson Grass. A coarse grass with stout root stocks; valuable for fodder in warm climates. Known by several other names. Native of the Old World.

Trifolium hybridum, L. Alsike Clover. Usually fickle and unreliable as a pasture and meadow plant, thriving best on moist soil. The stems are weak. The flowers valuable for honey bees. Native of Europe.

Trifolium medium, L. Mammoth or Late Clover. A large and late plant, often perennial, increasing in the esteem of farmers. Much like common red clover, with which it is often mixed. Native of Europe.

Trifolium pratense, L. Red or Early Clover. A well known biennial leguminous plant; very valuable for grazing or mowing. In some way through the tubercles of the roots it is enabled to assimilate free nitrogen. Native of Europe.

Zizania aquatica, L. Wild or Indian Rice. An aquatic annual grass. One of the largest found in the northern states The grain shells very freely, a little at a time as it ripens; is of a dark color, but is as palatable for food as rice in cultivation. Of much value in lakes and rivers of this country for water fowl. Worthy of testing.

STUDENTS' DRAWINGS, BOTANICAL NOTES AND A FEW EXAMINATION PAPERS.

There were sent to the exhibition nine volumes containing the results of students' work in the laboratory and botanic garden:

Volume 1. The notes of members of the Freshman class in 1879, concerning the special ways in which certain flowers are fertilized by insects.

by the wind, or by humming birds; the mode of climbing of some vines, the order of development of the parts of certain flowers, the work of cuscuta, a study of cleistogamous flowers of a violet.

Volume 2. Notes of original work done by members of the Freshman class during their first term of the study of botany in 1880, mostly consisting of a comparison, by each, of the buds and young branches of two species of trees or shrubs.

Volume 3. Notes of some of the original work done during the second term of botany by members of the Freshman class in 1880. The class consisted of fifty-one members, and the work of each is here represented without corrections or additions. The subjects varied much in their nature, such as the modes of fertilization of the flowers, methods of climbing, distribution of a certain kind of seeds, the study of seedlings, the depth of roots in the soil, how insects are caught by the flowers of Apocynum.

Volume 4. Notes and drawings prepared by a class of six persons beginning the use of a compound microscope in the study of botany during a course of six weeks in 1880.

Volume 5. A record of some of the special work done by each member of a class of one hundred and eight persons beginning botany in a term of twelve weeks in 1881. The theses were read and defended before the teacher in the presence of the class. The range of subjects is a wide one, but all were believed to be suitable for students in this stage of advancement.

Volume 6. Drawing and notes of all the members of a class of thirty-four persons in histological botany, beginning with the use of a compound microscope for six weeks only, daily, in 1881.

Volume 7. Notes and drawings of six special students, each having a different subject, but in most cases they consulted each other freely and made comparisons. The subjects were Indian corn, wheat, wild rice, the squash plant, apple blossoms, and a few algæ. The work was performed during a portion of one term in 1881 and 1882.

Volume 8. In the Senior year in 1882, twenty-four students began with the use of a compound microscope for six weeks only, daily, the study of plant histology. All of the work of each person is here presented without correction.

Volume 9. This volume contains complete, without corrections, the examination papers of three classes ending November 12, 1892, viz.: In systematic botany, the class had lessons daily for six weeks. There were twenty-nine in the class.

In Cryptogamic botany a class of eight Seniors worked daily for twelve weeks.

In the study of weeds by six resident graduate three times a week for six weeks.

INK DRAWINGS.

Sets of Ink Drawings made by students, on cards, as follows:

Drawings and notes concerning parasitic fungi made by Kizo Tamari, of Japan, while a resident graduate in 1886. He has for some time been professor of agriculture in the university of Tokio, Japan.

Drawings and notes concerning Uredineæ made by C. Yoshida, while a resdent graduate in 1890. Since 1892 he has been professor of botany in the Agricultural College, Totori Province, Japan.

Some drawings of a miscellaneous character made by J. W. Toumey, while instructor in botany in 1882. Most of them are without full notes; none were made with reference to an exhibition. Mr. Toumey is now professor of botany in Arizona University.

Numbers 1, 2, 3, 4, represent the outer coverings of a grain of wheat; numbers 5, 6, 7, 8, 9, the teleutospores and spermatia of *Puccinia graminis*, or wheat rust; numbers 10, 11, 12, the continuity of protoplasm in the cortical layer of woody plants; numbers 13, 14, 15, nodules on roots of *Ceanothus Americanus*.

In the set below the last named drawings the four vertical rows at the left are selections from the work of every member of a small class of Seniors in cryptogamic botany in 1892. The four vertical rows at the right are selections from the work of two resident graduates: A. T. Gordon, in 1892, at the top; L. H. Dewey, in 1888, below.

Selections of drawings and notes of members of the Senior class in 1891, beginning cryptogamic botany with daily work for twelve weeks.

Notes and drawings of most members of the Sophomore class in 1892, in beginning histological botany for twelve weeks.

CRUDE DRUGS, CONSISTING OF MICHIGAN PLANTS WHICH ARE ADMITTED TO THE UNITED STATES PHARMACOPŒIA.

This list complete—54 in all—was placed on exhibition, a pint of each kind in a screw-capped jar.

Acorus calamus, L. Sweet Flag.
Agropyrum repens, Beauv. Couch-grass.
Apocynum cannabinum, L. Indian Hemp.
Arctostaphylos uva-ursi, Spreng. Bearberry.
Arctium lappa, L. Burdock.
Artemisia absinthium, L. Wormwood.
Aspidium filix-mas, Swz. Male Fern.
Brassica alba, Boiss. White Mustard.
" *nigra*, Koch. Black "
Cannabis sativa, L. Hemp.
Carum carui, L. Caraway.
Castanea sativa, Mill., var. *americana*. Chestnut.
Chelidonium majus, L. Garden Celandine.
Chenopodium ambrosioides, L., var., *anthelminticum*. Wormseed.
Chimaphila umbellata, Nutt. Pipsissewa.
Cimicifuga racemosa, Nutt. Black Snakeroot. Black Cohosh.
Cornus florida, L. Flowering Dogwood.
Cypripedium pubescens, Willd. Yellow Lady's Slipper.
Datura stramonium, L. Stramonium.
Euonymus atropurpureus, Jacq. Waahoo.
Eupatorium perfoliatum, L. Boneset.
Gaultheria procumbens, L. Wintergreen.
Geranium maculatum, L. Cranesbill.
Hamamelis virginiana, Witch Hazel.
Hedeoma pulegioides, Pers. American Pennyroyal.
Humulus lupulus, L. Common hop.
Hydrastis canadensis, L. Golden Seal.
Hyoscyamus niger, L. Black Henbane.
Inula helenium, L. Elecampane.
Iris versicolor, L. Blue Flag.
Juglans cinerea, L. Butternut.
Juniperus communis, L. Juniper.
Linum usitatissimum. Flax.
Lobelia inflata, L. Indian Tobacco. Lobelia.

Marrubium vulgare, L. Horehound.
Mentha piperita, L. Peppermint.
" *viridis*, L. Spearmint.
Phytolacca decandra, L. Pokeweed. Scoke.
Podophyllum peltatum, L. Mandrake.
Polygala senega, L. Senega. Seneca Snakeroot.
Prunus serotina, Ehrh. Wild Black Cherry.
Quercus alba, L. White Oak.
Rubus villosus, Ait. Blackberry.
Rumex crispus, L. Curled Dock. Narrow-leaved Dock.
Sambucus canadensis, L. Elder.
Sanguinaria canadensis, L. Blood-root.
Sassafras officinale, Nees. Sassafras.
Scutellaria lateriflora, L. Skullcap.
Solanum dulcamara, L. Bittersweet.
Tanacetum vulgare, L. Tansy.
Taraxacum officinale, Weber. Dandelion.
Ulmus fulva, Michx. Slippery Elm.
Veronica virginica, L. Culver's Physic.
Xanthoxylum americanum, Mill. Prickly Ash.

A CONVENIENT HERBARIUM CASE

containing four verticle rows of "pigeon" holes for dried plants was on exhibition and contained the following:

HERBARIUM SPECIMENS ILLUSTRATING CERTAIN ECONOMIC FEATURES OF THE FLORA OF MICHIGAN, CLASSIFIED AS FOLLOWS:

NATIVE TREES AND SHRUBS SELECTED FOR THE COLOR OF THEIR LEAVES IN AUTUMN.

a. Green.
Abies balsamea, Miller. Balsam Fir. After fifteen years it usually loses its beauty.
Juniperus virginiana, L. Red Cedar. Becomes brown in winter.
Picea alba, Link. White Spruce.
" *nigra*, Link. Black Spruce. A slow grower.
Pinus banksiana, Lambert. Jack or Scrub Pine.
" *resinosa*, Ait. Norway or Red Pine. Better than the Austrian.
" *strobus*, L. White Pine.
Thuya occidentalis, L. Arbor Vitæ. White Cedar.
Tsuga canadensis, Carr. Hemlock. Needs protection from the strongest winds.
b. *Brown.*
The plants under this head are so numerous and inconspicuous that no exhibit was made.
c. *Yellow and orange.*
Acer saccharinum, Wang. Sugar Maple.
" *saccharinum*, Wang., var. *nigrum*, Torr. and Gray. Black Maple.
Amelanchier canadensis, Torr. and Gray. Service Berry, Shad Bush.
Betula papyrifera, Marshall. Paper or Canoe Birch.
Corylus americana, Walt. Hazel-nut.
" *rostrata*, Ait. Beaked Hazel-nut.
Fagus ferruginea, Ait. Beech.
Hamamelis virginiana, L. Witch-hazel.
Larix americana, Michx. Tamarack.
Populus grandidentata, Michx. Large-toothed Aspen.
" *monilifera*, Ait. Cotton-wood.
" *tremuloides*, Michx. American Aspen.
Rhus toxicodendron, L. Poison Ivy.
d. *Scarlet, Crimson, Red.*
Acer rubrum, L. Red Maple.
" *spicatum*, Lam. Mountain Maple.
Ampelopsis quinquefolia, Michx. Virginian Creeper. Our most valuable native vine.

Arctostaphylos uva-ursi, Spreng. Bearberry.
Cornus florida, L. Flowering Dogwood.
Gaultheria procumbens, L. Wintergreen.
Gaylussacia resinosa, Torr. and Gray. Black Huckleberry.
Nyssa sylvatica, Marsh. Pepperidge. Sour Gum.
Quercus coccinea, Wang. Scarlet Oak.
" *rubra*, L. Red Oak.
Rhus copallina, L. Dwarf Sumach.
" *typhina*, L. Staghorn Sumach.
" *venenata*, D. C. Poison Sumach.
Rubus canadensis, L. Dewberry.
" *hispidus*, L. Swamp Blackberry.
" *villosus*, Ait. High Blackberry.
Vaccinium canadense, Kalm. Dwarf Blueberry.
Vaccinium pennsylvanicum, Lam. Dwarf Blueberry.
" *vacillans*, Solander. Low Blueberry.

NATIVE SMALL TREES OR SHRUBS DISTINGUISHED FOR THEIR FLOWERS.

Amelanchier alnifolia, Nutt. Service-berry.
" *canadensis*, Torr. and Gray. June Berry.
" *oligocarpa*, Roem. Service-berry.
Cassandra calyculata, Don. Leather-leaf.
Ceanothus americanus, L. New Jersey Tea. Red-root.
" *ovatus*, Desf.
Cephalanthus occidentalis, L. Button-bush.
Cercis Canadensis, L. Red-bud. Judas-tree.
Cornus florida, L. Flowering Dogwood.
Crataegus coccinea, L. Scarlet-fruited Thorn.
" *crus-galli*, L. Cockspur Thorn.
" *punctata*, Jacq.
" *tomentosa*, L.
Hypericum kalmianum, L. Kalm's St. Johns-wort.
" *prolificum*, L. Shrubby " "
Kalmia augustifolia, L. Lambkill.
" *glauca*, Ait. Pale Laurel.
Ledum latifolium, Ait. Labrador Tea.
Lonicera ciliata, Muhl. Fly Honeysuckle.
" *oblongifolia*, Muhl. Swamp Fly Honeysuckle.
Physocarpus opulifolius, Maxim. Nine-bark.
Potentilla fruticosa, L. Shrubby Cinque-foil.
Prunus americana, Marshall. Wild Plum.
" *pennsylvanica*, L. f. Wild Red or Pin Cherry.
" *pumila*, L. Sand Cherry. Dwarf Cherry.
" *serotina*, Ehrb. Wild Black Cherry.
" *virginiana*, L. Choke-cherry.
Pyrus americana, DC. Mountain-ash.
" *arbutifolia*, L. f. Choke-berry.
" " var. *melanocarpa*, Hook. Choke-berry.
" *coronaria*, L. Wild Crab-apple.
" *sambucifolia*, Cham. and Schlecht. Elder-leaved Mountain-ash.
Rosa.
" *blanda*, Ait. Early Wild Rose.
" *carolina*, L. Swamp Rose.
" *engelmanni*, Watson. Engelmann's Rose.
" *humilis*, Marsh. Low Rose.
" *sayi*, Schwein. Say's Rose.
" *setigera*, Michx. Climbing or Prairie Rose.
Rubus Nutkanus, Mocino. White Flowering-raspberry. Salmon-berry.
" *odoratus*, Purple Flowering-raspberry.
Sambucus canadensis, L. Common Elder.
" *racemosa*, L. Red-berried Elder.
Spiræa salicifolia, L. Meadow-sweet.
" *tomentosa*, L. Hardhack. Steeple-bush.
Viburnum pubescens, Pursh. Downy Arrow-wood.

NATIVE SHRUBS OR TREES DISTINGUISHED FOR BEAUTIFUL FRUIT.

Celastrus scandens, L. Staff-tree. Shrubby Bitter-sweet.
Clematis virginiana, L. Virgin's-Bower.
Cornus florida, L. Flowering Dogwood.
Cratægus coccinea, L. Scarlet-fruited Thorn.
Cratægus tomentosa, L. Hawthorn.
Euonymus americanus, L. var. *obovatus*. Torr. and Gray. Trailing Strawberry Bush.
Euonymus atropurpureus, Jacq. Waahoo. Burning-bush.
Ilex verticillata, Gray. Winterberry. Black Alder.
Lonicera, Seven species.
Menispermum canadense, L. Moonseed.
Nemopanthes fascicularis, Raf. Mountain Holly.
Pyrus americana, DC. Mountain ash.
" *sambucifolia*, Cham. and Schlecht. Mountain ash.
Rhus glabra, L. Smooth Sumach.
" *typhina*,, L. Staghorn Sumach.
Rosa. Six species.
Sambucus racemosa, L. Red-berried Elder.
Sassafras officinale, Nees. Sassafras.
Symphoricarpos occidentalis, Hook. Wolfberry.
" *racemosus*, Michx. Snowberry.
Taxus canadensis, Willd. Ground Hemlock. American Yew.
Viburnum opulus, L. Cranberry-tree.
Xanthoxylum americanum, Mill. Prickly Ash.

A LIST OF NATIVE TREES AND SHRUBS DISTINGUISHED FOR THEIR SHOWY OR BRILLIANT COLORED BARK.

Acer pennsylvanicum, L. Striped Maple.
" *rubrum*, L. Red Maple.
" *spicatum*, Lam. Mountain Maple.
Betula papyrifera, Marsh. Paper or Canoe Birch.
Cornus sericea, L. Silky Cornel. Kinnikinnik.
" *stolonifera*, Michx. Red-osier. Dog-wood.
Negudo aceroides, Moench. Box-elder.
Platanus occidentalis, L. Buttonwood. Sycamore.
Rubus villosus. Ait. Blackberry.
Salix humilis, Marsh. Low Willow. Prairie Willow.
" *lucida*, Muhl. Shining Willow.
" *petiolaris*, Smith.
Sassafras officinale, Nees. Sassafras.
Smilax hispida, Muhl. Greenbrier.

NATIVE CLIMBING PLANTS.

These may be divided into five sections according to their method of getting themselves up in the world.

SECTION 1. *Root Climbers.*

Ampelopsis quinquefolia, Michx. Virginian Creeper. American Ivy. Sometimes by roots; but mostly by tendrils.
Rhus toxicodendron, L. Poison Ivy.

SECTION 2. *Twiners.*

a. Woody Twiners.

Celastrus scandens, L. Climbing Bitter-sweet. Wax-work.
Lonicera glauca, Hill. Small Glaucous Honeysuckle.
" *hirsuta*, Eaton. Hairy Honeysuckle.
Menispermum canadense, L. Moonseed.

b. Herbaceous Twiners.

Apios tuberosa, Mœnch. Ground-nut.
Convolvulus sepium, L. Hedge Bindweed.
Dioscorea villosa, L. Wild Yam.
Humulus lupulus, L. Hop.
Ipomœa pandurata, Meyer. Wild Potato Vine.
Polygonum cilinode, Michx. Fringe-jointed Polygonum.
" *dumetorum*, L., var. *scandens*, Gray. Climbing Buckwheat.

SECTION 3. *Leaf Climbers.*

Adlumia cirrhosa, Raf. Climbing Fumitory or Mountain Fringe.
Clematis virginiana, *L.* Virgin's-bower.

SECTION 4. *Tendril Climbers.*

Ampelopsis quinquefolia, Michx. Virginia Creeper. Five-leaved Ivy.
Echinocystis lobata, Torr. and Gray. Wild Cucumber.
Smilax hispida, Muhl. Greenbrier.

SECTION 5. *Climbing by recruved Prickles.*

Galium asprellum, Michx. Rough Bedstraw.
Rosa setigera, Michx. Prairie Rose. Climbing Rose.

NATIVE PLANTS WHICH ARE VERY LIGHT COLORED.

a. Glaucous.

Alopecurus geniculatus, L., var. *aristulatus*, Torr. Fox-tail Grass.
Andromeda polifolia, L.
Baptisia tinctoria, R. Br. Wild Indigo.
Corydalis glauca, Pursh. Pale Corydalis.
Dicentra canadensis, DC. Squirrel Corn.
" *cucullaria*, DC. Dutchman's Breeches.
Kalmia glauca, Ait. Pale Laurel.
Lonicera glauca, Hill. Glaucous Honeysuckle.
Agropyrum dasystachyum, Vasey.

b. Clothed with White Hairs.

Amelanchier canadensis, T. and G., var. *oblongifolia*, T. and G. Service Berry.
Anemone cylindrica, Gray. Long-fruited Anemone.
Anaphalis margaritacea, B. and H. Pearly Everlasting.
Artemisia canadensis, Michx. Wild Wormwood.
" *ludoviciana*, Nutt. Western Mugwort.
Antennaria plantaginifolia, Hook. Plaintain-leaved Everlasting.
Cnicus altissimus, Willd. Tall Thistle.
" *pitcheri*, Torr. Pitcher's Thistle.
Gnaphalium decurrens, Ives. Everlasting.
" *polycephalum*, Michx. Common Everlasting.
" *purpureum*, L. Purplish Cudweed.
" *uliginosum*, L. Low Cudweed.
Potentilla anserina, L. Silver-weed.
" *argentea*, L. Silvery Cinque-foil.

A LIST OF SMALL EVERGREENS.

Antennaria plantaginifolia, Hook, Plantain-leaved Everlasting.
Arctostaphylos uva-ursi, Spreng. Bearberry.
Aspidium acrostichoides, Swz. Christmas Fern.
" *marginale*, Swz. Shield Fern.
Cassandra calyculata, Don. Leather-leaf.
Chimaphila maculata, Pursh. Spotted Wintergreen.
" *umbellata*, Nutt. Prince's Pine.
Coptis trifolia, Salisb. Goldthread.
Epigæa repens, L. Trailing Arbutus.
Gaultheria procumbens, L. Creeping Wintergreen.
Hepatica acutiloba, DC. Liver-leaf. Hepatica.

Hepatica triloba, Chaix. Liver-leaf. Hepatica.
Hudsonia tomentosa, Nutt.
Lechea major, Michx. Pinweed.
" *minor*, L. Pinweed.
Mitchella repens, L. Partridge Berry.
Phlox bifida, Beck.
" *divaricata*, L.
Polypodium vulgare, L. Polypody.
Potentilla tridentata, Ait. Three-toothed Cinque-foil.
Pyrola elliptica, Shin-leaf.
" *rotundifolia*, L. Shin-leaf.
" *secunda*, L. Shin-leaf.
Vaccinium macrocarpon,, Ait. Large Cranberry.
" *oxycoccus*, L. Small Cranberry.
Waldsteinia fragarioides, Tratt. Barren Strawberry.

BRONZE EVERGREENS.

The leaves of the following evergreens often assume a bronze color in autumn.

Arctostaphylos uva-ursi, Spreng. Bearberry.
Epigœa repens, L. Trailing Arbutus.
Gaultheria procumbens, L. Creeping Wintergreen.
Rubus hispidus, L. Running Swamp-blackberry.
Sarracenia purpurea, L. Pitcher-plant.
Vaccinum canadense, Kalm. Dwarf Blueberry.
" *macrocarpon*, Ait. Large Cranberry.
" *oxycoccus*, L. Small Cranberry.
" *pennsylvanicum*, Lam. Dwarf Blueberry.
" *vacillans*, Solander. Low Blueberry.

To this list, also, other plants might be added.

PLANTS SUITABLE FOR WINTER BOQUETS.

Antennaria margaritacea, Benth. and Hook. Pearly Everlasting.
Celastrus scandens, L. (fruit). Wax-work. Climbing Bitter-sweet.
Clematis virginiana, L. " Virgin's-bower.
Cyperus. Different species, cut young.
Dioscorea villosa, L. (fruit). Wild Yam.
Eriophorum cyperinum, L. Cotton-grass.
" *lineatum*, Benth. and Hook. Cotton-grass.
Euonymus americanus, L., var. *obovatus*, Torr. and Gray. Strawberry Bush.
" *atropurpureus*, Jacq. Wahoo.
Gnaphalium decurrens, Ives. Everlasting.
" *polycephalum*, Michx. Common Everlasting.
Grasses. Some species cut young.
Liatris scariosa, Willd. Blazing-star.
Staphylea trifolia, L. (fruit). American Bladder-nut.
Solidago. Several species.

NATIVE BOG AND MARSH PLANTS WHICH ARE PROMISING FOR CULTIVATION.

Acorus calamus, L. Sweet Flag.
Alopecurus geniculatus, L. var. *aristulatus*, Torr. Foxtail Grass.
Andromeda polifolia, Salisb. Andromeda.
Arethusa bulbosa, L. An orchid.
Asclepias incarnata, L. Swamp Milkweed.
Aspidium cristatum, Swz. Shield Fern.
" *thelypteris*, Swz. Shield Fern.
Aster novæ-angliæ, L. Aster.
" *puniceus*, L. Aster.

Calla palustris, L. Calla.
Calopogon pulchellus, R. Br. An orchid.
Caltha palustris, L. Marsh Marigold.
Calypso borealis, Salisb. An orchid.
Campanula aparinoides, Pursh. Marsh Bellflower.
Cardamine pratensis, L. Cuckoo Flower.
" *rhomboidea*, DC. Spring Cress.
" " var. *purpurea*, Torr. Spring Cress.
Carex. Many species.
Cassandra calyculata, Don. Leather-leaf.
Chelone glabra, L. Turtle-head. Snake-head.
Chiogenes serpyllifolia, Salisb. Creeping Snowberry.
Clintonia borealis, Raf.
Cnicus muticus, Pursh. Swamp Thistle.
Coptis trifolia, Salisb. Three-leaved Goldthread.
Coreopsis trichosperma, Michx. Tickseed Sunflower.
Cypripedium acaule, Ait. Stemless Lady's Slipper.
" *candidum*, Muhl. Small White Lady's Slipper.
" *parviflorum*, Salisb. Yellow Lady's Slipper.
" *pubescens*, Willd. Larger Yellow Lady's Slipper.
" *spectabile*, Salisb. Showy Lady's Slipper.
Drosera rotundifolia, L. Round-leaved Sundew.
Dulichium spathaceum, Pers.
Eriophorum polystachyon, L. Cotton grass.
Gentiana crinita, Froel. Gentian.
" *quinqueflora*, Lam. Gentian.
" *serrata*, Gunner. Gentian.
Geum rivale, L. Water or Purple Avens.
Glyceria canadensis, Trin. Rattlesnake Grass.
Habenaria ciliaris, R. Br. Yellow Fringed-orchis.
" *dilatata*, Gray.
" *fimbriata*, R. Br. Purple Fringed-orchis.
" *psycodes*, Gray. Purple Fringed-orchis.
Helenium autumnale, L. Sneeze-weed.
Hibiscus moscheutos, L. Swamp Rose-mallow.
Hydrocotyle umbellata, L. Water Pennywort.
Impatiens fulva, Nutt. Spotted Touch-me-not.
" *pallida*, Nutt. Pale Touch-me-not.
Iris versicolor, L. Blue Flag.
Kalmia glauca, Ait. Pale Laurel.
Lathyrus palustris, L. Vetchling,
" " " var. *myrtifolius*, Gray. Vetchling.
Ledum latifolium, Ait. Labrador Tea.
Lobelia cardinalis, L. Cardinal-flower.
" *syphilitica*, L. Great Lobelia.
Lonicera oblongifolia, Muhl. Swamp Fly-honeysuckle.
Lysimachia quadrifolia, L. Loosestrife.
" *stricta*, Ait. Loosestrife.
" *thyrsiflora*, L. Tufted Loosestrife.
Menyanthes trifoliata, L. Buckbean.
Muhlenbergia glomerata, Trin. Drop-seed.
Osmunda cinnamomea, L. Cinnamon Fern.
" *claytoniana*, L. Flowering Fern.
" *regalis*, L. Flowering Fern.
Parnassia (either species). Grass of Parnassus.
Pedicularis lanceolata, Michx. Lousewort.
Petasites palmata, Gray. Sweet Coltsfoot.
Phragmites communis, Trin. Reed Grass.
Pinguicula vulgaris, L. Butterwort.
Plantago cordata, Lam. Plantain.
Pogonia ophioglossoides, Nutt. An orchid.
Polygonum amphibium, L. Knotweed.
" *hartwrightii*, Gray. Knotweed.
Potentilla anserina, L. Silver-weed.
" *palustris*, Scop. Marsh Five-finger.

Primula farinosa, L. Bird's eye Primrose.
" *mistassinica*, Michx. Primrose.
Rudbeckia speciosa, Wend. Cone-flower.
Rumex britannica, L. Great Water-dock.
" *verticillatus*, L. Swamp Dock.
Salix candida, Willd. Willow.
" *myrtilloides*, L. Willow.
Sarracenia purpurea, L. Side-saddle Flower. Pitcher-plant.
Saxifraga pennsylvanica, L. Swamp Saxifrage.
Scutellaria galericulata, L. Skullcap.
Senecio aureus, L. Golden Ragwort. Squaw-weed.
Smilacina trifolia, Desf. False Solomon's seal.
Solidago ohioensis, Riddell. Golden-rod.
" *patula*, Muhl. Golden-rod.
" *riddellii*, Frank. Golden-rod.
" *uliginosa*, Nutt. Golden-rod.
Spartina cynosuroides, Willd. Fresh-water Cord-grass.
Steironema ciliatum, Raf. Loosestrife.
Symplocarpus fœtidus, Salisb. Skunk Cabbage.
Vaccinium macrocarpon, Ait. Cranberry.
Valeriana sylvatica, Banks. Valerian.
Viola blanda, Willd. White Violet.
Woodwardia angustifolia, Smith. Chain-fern.
" *virginica*, Smith. Chain-fern.

NATIVE AQUATIC PLANTS MOST WORTHY OF CULTIVATION.

Alisma plantago, L. Water-plantain.
Brasenia peltata, Pursh. Water-shield.
Glyceria fluitans, R. Br. Water Manna-grass.
Leersia oryzoides, Swz. Rice Cut-grass.
Lemna minor, L. Duckweed. Duck's-meat.
" *trisulca*, L. Duckweed. Duck's-meat.
Minulus jamesii, Torr. James' Monkey-flower.
Nuphar advena, Ait. f. Yellow Pond-lily. Spatter-dock.
" " var. *minus*, Morong. Small Yellow Pond-lily.
Nymphæa odorata, Ait. Sweet-scented Water-lily. A pink form found in Otsego lake, Otsego county, is especially fine.
Nymphæa reniformis, DC. Tuber-bearing Water-lily.
Peltandra undulata, Raf. Arrow Arum.
Pontederia cordata, L. Pickerel-weed.
Potamogeton natans, L. Pondweed.
Ranunculus aquatilis, L. var. *trichophyllus*, Gray. White Water-crowfoot.
" *circinatus*, Sibth. Stiff Water-crowfoot.
" *multifidus*, Pursh. Yellow Water-crowfoot.
Sagittaria variabilis, Eng. Arrow-head.
Saururus cernuus, L. Lizard's-tail.
Scirpus fluviatilis, Gray, Bulrush.
Sparganium eurycarpum, Eng. Bur-reed.
Spirodela polyrrhiza, Schleid. Duck's-meat.
Typha latifolia, L. Cat-tail Flag.
" *angustifolia*, L. Narrow-leaved Cat-tail Flag.
Utricularia cornuta, Michx. Bladderwort.
" *vulgaris*, L. Bladderwort.
Zizania aquatica, L. Wild Rice.

A LIST OF NATIVE FERNS PROMISING FOR CULTIVATION.

a. Thriving in sun or shade in poor soil.

Pteris aquilina, L. Eagle Fern. Common Brake.

b. Thriving in cool, rocky places.

Asplenium ebeneum, Ait. Spleenwort.
" *ruta-muraria*, L. Spleenwort.
" *trichomanes*, L. Spleenwort.
Aspidium filix-mas, Swz. Male Fern.
" *fragrans*, Swz. Shield Fern.
Camptosorus rhizophyllus, Link. Walking-leaf.
Cryptogramme acrostichoides, R. Br. Rock-brake.
Pellæa gracilis, Hook. Cliff-brake.
Pellæa atropurpurea, Link. Cliff-brake.
Polypodium vulgare, L. Polypody.
Woodsia ilvensis, R. Br.
" *oregana*, D. C. Eaton.
" *scopulina*, D. C. Eaton.

c. *Thriving in bogs or swamps.*

Aspidium cristatum, Swz. Shield Fern.
" *noveboracense*, Swz. Shield Fern.
" *thelypteris*, Swz. Shield Fern.
Woodwardia angustifolia, Smith. Chain-fern.
" *virginica*, Smith. Chain-fern.

d. *Thriving in rich woods.*

Adiantum pedatum, L. Maidenhair.
Asplenium angustifolium, Michx. Spleenwort.
" *filix-fœmina*, Bernh. Spleenwort.
" *thelypteroides*, Michx. Spleenwort.
Aspidium acrostichoides, Swartz. Shield Fern.
" *aculeatum*, Swartz, var. *braunii*, Koch. Shield Fern.
" *boottii*, Tuckerman. Shield Fern.
" *goldianum*, Hook. Shield Fern.
" *lonchitis*, Swartz. Shield Fern.
" *marginale*, Swartz. Shield Fern.
" *spinulosum*, Swartz. Shield Fern.
" " " var. *intermedium*, D. C. Eaton. Shield Fern.
Cystopteris bulbifera, Bernh. Bladder Fern.
" *fragilis*, Bernh. Bladder Fern.
Dicksonia pilosiuscula, Willd.
Onoclea sensibilis, L. Sensitive Fern.
" *struthiopteris*, Hoffman, Ostrich Fern.
Osmunda cinnamomea, L. Cinnamon Fern.
" *claytoniana*, L. Flowering Fern.
" *regalis*, L. Flowering Fern.
Phegopteris dryopteris, Fée. Beech Fern.
" *hexagonoptera*, Fée. Beech Fern.
" *polypodioides*, Fée. Beech Fern.

PLANTS INDICATING A FERTILE SOIL.

Acer saccharinum, Wang. Sugar maple, when the wood is solid and of fine quality.
" " " var. *nigrum*, Torr. and Gray. Black sugar Maple.
Adiantum pedatum, L. Maidenhair Fern.
Angelica atropurpurea, L. Angelica.
Apios tuberosa, Mœnch. Wild Bean. Ground-nut.
Arisæma triphyllum, Torr. Indian Turnip.
Asplenium angustifolium, Michx. Spleenwort.
" *thelypteroides*, Michx. Spleenwort.
Cassia marilandica, L. Wild Senna.
Collinsonia canadensis, L. Rich-weed. Stone-root.
Cratægus tomentosa, L. Hawthorn.
Dentaria diphylla, Michx. Toothwort. Pepper-root.
" *laciniata*, Muhl. Toothwort. Pepper-root.
Dicentra canadensis, DC. Squirrel Corn.
" *cucullaria*, DC. Dutchman's Breeches.

Fraxinus americana, L. White Ash.
" *quadrangulata*, Michx. Blue Ash.
Hydrastis canadensis, L. Golden Seal.
Hydrophyllum canadense, L. Waterleaf.
" *virginicum*, L. Waterleaf.
Juglans cinerea, L. Butternut.
" *nigra*, L. Black Walnut.
Menispermum canadense, L. Moonseed.
Orchis spectabilis, L. Showy Orchis.
Podophyllum peltatum, L. May-apple. Mandrake.
Quercus alba, L. White Oak. When well grown.
" *macrocarpa*, Michx. Bur-oak.
Ribes cynosbati, L. Prickly Gooseberry.
Rubus occidentalis, L. Black Raspberry.
Scrophularia nodosa, L., var. *marilandica*, Gray. Figwort.
Taraxacum officinale, Weber. Dandelion.
Tilia americana, L. Basswood.
Ulmus americana, L. American Elm.
" *racemosa*, Thomas. Rock Elm.
Uvularia grandiflora, Smith. Bellwort.
Verbena hastata, L. Blue Vervain.

When full grown and of good size, several other trees are indications of good soil.

PLANTS INDICATING A STERILE SOIL.

The following twenty species of plants are almost certain to be found in considerable quantity on any extended area of Jack-pine plains, and taken together are a good indication of a poor soil:

Andropogon furcatus, Muhl. Finger or Beard-grass.
" *scoparius*, Michx. Beard-grass.
Arctostaphylos uva-ursi, Spreng. Bearberry.
Aster laevis, L. Aster.
Carex pennsylvanica, Lam. Pennsylvania Sedge.
Danthonia spicata, Beauv. Wild Oat-grass.
Epigœa repens, L. Trailing Arbutus.
Erigeron canadensis, L. Horse-weed.
Gaultheria procumbens, L. Wintergreen.
Myrica asplenifolia, Endl. Sweet Fern.
Oryzopsis canadensis, Torr. Mountain Rice.
Pinus banksiana, Lambert. Scrub or Jack-pine.
Populus tremuloides, Michx. Aspen.
Prunus virginiana, L. Choke-cherry.
Pteris aquilina, L. Brake. Eagle Fern.
Quercus coccinea, Wang. Scarlet Oak.
" *tinctoria*, Bartr. Black Oak.
Rumex acetosella, L. Sheep Sorrel.
Salix humilis, Marsh. Low or Prairie Willow.
Solidago nemoralis, Ait. Golden-rod.
Vaccinium canadense, Kalm. Low Blueberry.
" *pennsylvanicum*, Lam. Dwarf Blueberry.
" *vacillans*, Solander. Low Blueberry.

LIST OF WILD FRUITS, NUTS, ETC.

Amelanchier canadensis, Torr. and Gray, and varieties. Service-berry.
Asimina triloba, Dunal. Papaw.
Carya alba, Nutt. Shell-bark Hickory.
" *sulcata*, Nutt. Large Shell-bark Hickory. King-nut.
Castanea sativa, Mill., var. *americana*, Gray. American Chestnut.
Corylus americana, Walt. American Hazel-nut.
" *rostrata*, Ait. Beaked Hazel-nut.

Fagus ferruginea, Ait. Beech.
Fragaria vesca, L. Alpine Strawberry.
" *virginiana*, Mill. American Strawberry.
" " " var. *illinoensis*, Gray. Wild Strawberry.
Gaylussacia resinosa, Torr. and Gray. Black Huckleberry.
Juglans cinerea, L. Butternut.
" *nigra*, L. Black Walnut.
Morus rubra, L. Red Mulberry.
Podophyllum peltatum, L. May-apple. Mandrake.
Prunus americana, Marshall. Wild Red and Yellow Plum.
" *pumila*, L. Sand Cherry.
Pyrus coronaria, L. American Crab-apple.
Ribes cynosbati, L. Prickly Gooseberry.
" *floridum*, L'Her. Black Currant.
" *oxyacanthoides*, L. Smooth Wild Gooseberry.
" *rubrum*, L., var. *subglandulosum*, Maxim. Red Currant.
Rubus canadensis, L. Dewberry.
" *occidentalis*, L. Black-cap Raspberry.
" *strigosus*, Michx. Wild Red Raspberry.
" *villosus*, Ait. Blackberry.
Vaccinium canadense, Kalm. Canada Blueberry.
" *corymbosum*, L. Swamp-blueberry.
" *macrocarpon*, Ait. American Cranberry.
" *pennsylvanicum*, Lam. Drawf Early Blueberry.
" *vacillans*, Solander. Low Blueberry.
Vitis bicolor, LeConte. Summer Grape.
" *riparia*, Michx. Frost Grape.
Zizania aquatica, L. Wild Rice.

NATIVE PLANTS FOR THE PROTECTION OF HILLSIDES, EMBANKMENTS AND DRIFTING SANDS.

The following so far as we know are the most valuable:

Agropyrum repens, Beauv. Quick or Quack-grass. Well naturalized from Europe.
Ammophila arundinacea, Host. Sea Sand-reed.
Apocynum androsæmifolium, L. Spreading Dogbane.
" *cannabinum*, L. Indian Hemp.
Calamagrostis longifolia, Hook. Dogwood.
Carex siccata, Dewey. Sedge.
Cornus alternifolia, L. Dogwood.
" *baileyi*, Coult and Evans. Dogwood.
" *stricta*, Lam.
" *sericea*, L. Silky Cornel.
" *stolonifera*, Michx. Red-osier Dogwood.
Elymus canadensis, L. Wild Rye.
Equisetum arvense, L. Horstail. Scouring Rush.
" *pratense*, Ehrh. Horsetail. Scouring Rush.
Poa pratensis, L. June Grass.
Populus balsamifera, L. Balsam Poplar.
" *monilifera*, Ait. Cotton-wood.
" *tremuloides*, Michx. Aspen.
Prunus pumila, L. Dwarf Cherry.
Rubus strigosus, Michx. Red Raspberry.
Salix. Any of our native species growing near by.
Sambucus canadensis, L. Elder.
" *racemosa*, L. Elder.
Spartina cynosuroides, Willd. Cord-grass.
Viburnum. Any of our native species near at hand.

PLANTS FOR CARP PONDS.

Elodea canadensis, Michx. Water-weed.
Glyceria fluitans, R. Br. Manna-grass.
Lemna minor, L. Duckweed.
" *trisulca*, L. Duckweed.

Potamogeton. Any of our numerous species. Pondweed.
Ranunculus aquatilis, L., and its varieties. Water-crowfoot.
" *multifidus*, Pursh. Water-crowfoot.
Sagittaria variabilis, Engelm. Arrow-head.
Spirodela polyrrhiza, Schleid. Duckweed.
Spirogyra. Several species. Pond Scum.
Vallisneria spiralis, L. Eel-grass.
Vaucheria. Several species of green pond weeds.
Wolffia brasiliensis, Weddell.
" *columbiana*, Karsten.
Zizania aquatica, L. Wild Rice.

NATIVE TREE-LIKE OR LARGE SHRUBS.

Acer spicatum, Lam. Mountain Maple.
Alnus incana, Willd. Speckled Alder. Hoary Alder. Black Alder.
" *serrulata*, Willd. Smooth Alder. Black Alder.
Asimina triloba, Dunal. Papaw. Custard Apple.
Cercis canadensis, L. Red-bud. Judas-tree.
Cornus alternifolia, L. f. Dogwood.
" *circinata*, L'Her. Dogwood.
Cratægus coccinea, L. Scarlet Hawthorn. Red Hawthorn. White Thorn.
" *crus-galli*, L. Cockspur Thorn. Newcastle Thorn.
" *tomentosa*, L. Black Thorn. Pear Haw.
Euonymus atropurpureus, Jacq. Burning-bush. Waahoo. Spindle-tree. Arrow-wood.
Hamamelis virginica, L. Witch-hazel.
Prunus americana, Marshall. Wild Plum. Canada Plum. Horse Plum.
" *virginiana*, L. Choke-cherry.
Ptelea trifoliata, L. Hop-tree. Shrubby Trefoil. Wafer Ash.
Quercus prinoides, Willd. Chinquepin Oak.
Rhus copallina, L. Dwarf Sumach.
" *glabra*, L. Smooth Sumach.
" *typhina*, L. Staghorn Sumach.
" *venenata*, DC. Poison Sumach. Poison Dogwood.
Salix discolor, Muhl. Glaucous Willow.
" *longifolia*, Muhl. Sand-bar Willow.
" *lucida*, Muhl. Shining Willow.
Sambucus canadensis, L. Common Elder.
" *racemosa*, L. Red-berried Elder.
Staphylea trifolia, L. Bladder-nut.
Viburnum lentago, L. Sheep-berry. Nanny-berry.
" *prunifolium*, L. Black Haw. Stag-bush.
Xanthoxylum americanum, Mill. Prickly Ash. Toothache-tree.

FLOWERING PARASITES AND SAPROPHYTES DESTITUTE OF GREEN LEAVES.

Aphyllon fasiculatum, Gray. Cancer-root.
" *uniflorum*, Gray. Cancer-root.
Conopholis americana, Wallroth. Squaw-root.
Cuscuta chlorocarpa, Engelm. Dodder.
" *gronovii*, Willd. Dodder.
" *tenuiflora*, Engelm. Dodder.
Epiphegus virginiana, Bart. Beech-drops.
Monotropa hypopitys, L. Pine-sap. False Beech-drops.
" *uniflora*, L. Indian Pipe. Corpse-plant.
Pterospora andromedea, Nutt. Pine-drops.

GREEN-LEAVED PARASITES.

Castilleia coccinea, Spreng. Scarlet Painted-cup.
" *pallida*, Kunth, var., *septentrionalis*, Gray. Pale Painted-cup.
Comandra livida, Richardson. Bastard Toad-flax.
" *umbellata*, Nutt. Bastard Toad-flax.

Gerardia aspera, Dougl. Gerardia.
" *auriculata*, Michx. Gerardia.
" *flava*, L. Downy Foxglove.
" *lævigata*, Raf. Gerardia.
" *pedicularia*, L. Lousewort Foxglove.
" *purpurea*, L. Purple Gerardia.
" " var., *paupercula*, Gray. Purple Gerardia.
" *quercifolia*, Pursh. Smooth Foxglove.
" *tenuifolia*, Vahl. Slender Gerardia.
" " var., *asperula*, Gray. Slender Gerardia.

NATIVE PLANTS WHICH, WHEN TOUCHED, POISON MANY PERSONS.

Rhus toxicodendron, L. Poison Ivy.
" *venenata*, DC. Poison Sumach.

CRUDE DRUGS CONSISTING OF MICHIGAN PLANTS WHICH ARE ADMITTED TO THE UNITED STATES PHARMACOPŒIA.

The following species, 54 in all, are admitted to the United States pharmacopœia. When eaten, many of them are poisonous:

Acorus calamus, L. Sweet Flag.
Agropyrum repens, Beauv. Couch-grass.
Apocynum cannabinum, L. Indian Hemp.
Arctostaphylos uva-ursi, Spreng. Bearberry.
Arctium lappa, L. Burdock.
Artemisia absinthium, L. Wormwood.
Aspidium filix-mas, Swz. Male Fern.
Brassica alba, Boiss. White Mustard.
" *nigra*, Koch. Black Mustard.
Cannabis sativa, L. Hemp.
Carum carui, L. Caraway.
Castanea sativa, Mill., var. *americana*, Gray. Chestnut.
Chelidonium majus, L. Garden Celandine.
Chenopodium ambrosioides, L., var. *anthelminticum*, Gray. Wormseed.
Chimaphila umbellata, Nut. Pipsissewa.
Cimicifuga racemosa, Nutt. Black Snakeroot. Black Cohosh.
Cornus florida, L. Flowering Dogwood.
Cypripedium pubescens, Willd. Yellow Lady's Slipper.
Datura stramonium, L. Stramonium.
Euonymus atropurpureus, Jacq. Waahoo.
Eupatorium perfoliatum, L. Boneset.
Gaultheria procumbens, L. Wintergreen.
Geranium maculatum, L. Cranesbill.
Hamamelis virginiana, L. Witch-Hazel.
Hedeoma pulegioides, Pers. American Pennyroyal.
Humulus lupulus, L. Common Hop.
Hydrastis canadensis, L. Golden Seal.
Hyoscyamus niger, L. Black Henbane.
Inula helenium, L. Elecampane.
Iris versicolor, L. Blue Flag.
Juglans cinerea, L. Butternut.
Juniperus communis, L. Juniper.
Linum usitatissimum, L. Flax.
Lobelia inflata, L. Indian Tobacco. Lobelia.
Marrubium vulgare, L. Horehound.
Mentha piperita, L. Peppermint.
" *viridis*, L. Spearmint.
Phytolacca decandra, L. Pokeweed. Scoke.
Podophyllum peltatum, L. Mandrake.
Polygala senega, L. Senega. Seneca Snakeroot.
Prunus serotina, Ehrh. Wild Black Cherry.
Quercus alba, L. White Oak.

Rubus villosus, Ait. Blackberry.
Rumex crispus, L. Curled Dock. Narrow-leaved Dock.
Sambucus canadensis, L. Elder.
Sanguinaria canadensis, L. Blood-root.
Sassafras officinale, Nees. Sassafras.
Scutellaria lateriflora, L. Skullcap.
Solanum dulcamara, L. Bittersweet.
Tanacetum vulgare, L. Tansy.
Taraxacum officinale, Weber. Dandelion.
Ulmus fulva, Michx. Slippery Elm. Red Elm.
Veronica virginica, L. Culver's Physic.
Xanthoxylum americanum, Mill. Prickly Ash.

THE GRASSES OF MICHIGAN, NATIVE AND NATURALIZED.

Numbering 136 species and varieties:

Agropyrum repens, Beauv. Couch. Quitch. Quick or Quack-grass.
“ *dasystachyum*, Vasey.
“ *violaceum*, Lange.
“ *caninum*, R. and S. Awned Wheat-grass.
Agrostis alba, L. White Bent Grass.
“ “ var. *vulgaris*, Thurb. Red Top.
“ *perennans*, Tuckerman. Thin-grass.
“ *scabra*, Willd. Hair-grass.
“ *canina*, L. Brown Bent-grass.
Alopecurus pratensis, L. Meadow Foxtail.
“ *geniculatus*, L. Floating Foxtail.
“ “ var., *aristulatus*, Torr.
Ammophila arundinacea, Host. Sea Sand-reed.
Andropogon furcatus, Muhl. Beard-grass.
“ *scoparius*, Michx.
Anthoxanthum odoratum, L. Sweet Vernal Grass.
Apera spica-venti, Beauv.
Aristida purpurascens, Poir. Triple-awned Grass.
Arrhenatherum avenaceum, Beauv. Oat-grass.
Asprella hystrix, Willd. Bottle-brush Grass.
Avena striata, Michx. Oat-grass.
Bouteloua racemosa, Lag. Grama-grass.
Brachyelytrum aristatum, Beauv.
Bromus kalmii, Gray. Wild Chess.
“ *secalinus*, L. Cheat or Chess.
“ *ciliatus*, L.
“ *asper*, L.
“ *breviaristatus*, Thurb.
Calamagrostis canadensis, Beauv. Blue-Joint.
“ *stricta*, Trin.
“ *lapponica*, Trin.
“ *longifolia*, Hook.
Cenchrus tribuloides, L. Hedgehog or Bur-grass.
Chrysopogon nutans, Benth. Indian Grass.
Cinna arundinacea, L. Wood Reed-grass.
“ *pendula*, Trin.
Dactylis glomerata, L.
Danthonia spicata, Beauv. Wild Oat-grass.
“ *intermedia*, Vasey.
Deschampsia flexuosa, Trin. Common Hair-grass.
“ *caespitosa*, Beauv.
Diarrhena americana, Beauv.
Eatonia obtusata, Gray.
“ *pennsylvanica*, Gray.
“ *dudleyi*, Vasey.
Eleusine indica, Gaertn. Dog's-tail or Wire-grass.

Elymus virginicus, L. Wild Rye.
" *canadensis*, L.
" " var. *glaucifolius*, Gray.
" *striatus*, Willd.
" " var. *villosus*, Gray.
Elymus sibiricus, L., var. *americanus*, Gray.
Elymus mollis, Trin.
Eragrostis reptans, Nees.
" *major*, Host.
" *pilosa*, Beauv.
" *frankii*, Meyer.
" *capillaris*. L.
" *pectinacea*, Gray., var., *spectabilis*, Gray.
Festuca tenella, Willd. Fescue-grass.
" *ovina*, L. Sheep's Fescue.
" " var. *duriuscula*, Koch.
" *nutans*, Willd.
" *elatior*, L. Taller or Meadow Fescue.
" " var. *pratensis*, Gray. Meadow Fescue.
Glyceria canadensis, Trin. Rattlesnake Grass.
" *nervata*, Trin.
" *pallida*, Trin.
" *grandis*, Watson.
" *fluitans*, B. Br.
Graphephorum melicoideum, Desv.
" " var. *majus*, Gray.
Hierochloe borealis, R. and S. Holy Grass.
Hordeum jubatum, L. Squirrel-tail Grass.
Koeleria cristata, Pers.
Leersia virginica, Willd.
" *oryzoides*, Swz. Rice Cut-grass.
Lolium perenne, L. Common Darnel.
" *temulentum*, L. Bearded Darnel.
Milium effusum, L. Millet-grass.
Muhlenbergia glomerata, Trin. Drop-seed Grass.
" *mexicana*, Trin.
" *sylvatica*, Torr. and Gray.
" *willdenovii*, Trin.
" *diffusa*, Schreber. Nimble Will.
Oryzopsis melanocarpa, Muhl. Mountain Rice.
" *asperifolia*, Michx.
" *canadensis*, Torr.
Panicum glabrum, Gaud. Panic-grass.
" *sanguinale*, L. Common Crab or Finger Grass.
" *capillare*, L. Old-witch Grass.
" *agrostoides*, Muhl.
" *virgatum*, L.
" *xanthophysum*, Gray.
" *latifolium*, L.
" *clandestinum*, L.
" *scoparium*, Lam.
" *nitidum*, Michx. (Lam. ?)
" *microcarpon*, Muhl.
" *depauperatum*, Muhl.
" *dichotomum*, L.
" " var. *commune*, Wats.
" " " *fasciculatum*, Wats.
" " " *gracile*, Wats.
" *crus-galli*, L. Barnyard Grass.
" " var. *hispidum*, Gray.
Phalaris canariensis, L. Canary-grass.
" *arundinacea*, L. Reed Canary-grass.
Phleum pratense, L. Timothy.
" *alpinum*, L.
Phragmites communis, Trin.

Poa annua, L. Low Spear-grass.
“ *compressa*, L. Wire-grass. Blue-grass.
“ *alpina*, L.
“ *nemoralis*, L.
“ *serotina*, Ehrh. False Red-top. Fowl Meadow-grass.
“ *pratensis*, L. Kentucky Blue Grass. June Grass.
“ *trivialis*, L. Roughish Meadow-grass.
“ *sylvestris*, Gray.
“ *debilis*, Torr.
“ *alsodes*, Gray.
“ *flexuosa*, Muhl.
Setaria verticillata, Beauv.
“ *glauca*, Beauv. Foxtail. Pigeon-Grass.
“ *viridis*, Beauv. Green Foxtail. Bottle-grass.
“ *italica*, Kunth. Millet. Hungarian Grass.
Spartina cynosuroides, Willd. Fresh-water Cord Grass.
Sporobolus vaginaeflorus, Vasey. Drop-seed Grass.
“ *cryptandrus*, Gray.
“ *serotinus*, Gray.
Stipa avenacea, L. Black Oat-grass.
“ *spartea*, Trin. Porcupine Grass.
Triodia cuprea, Jacq. Tall Red-top.
Trisetum subspicatum, Beauv., var. *molle*, Gray.
“ *smithii*, Porter.
Zizania aquatica, L. Indian Rice. Water Oats.

HERBARIUM SPECIMENS OF 313 VARIETIES OF WHEAT GROWN AT THE COLLEGE IN 1892.

Alabama.
Algeria.
American.
American Bronze.
Andrew's No. 4.
April-oder-fern.
Armstrong.
Arnold Hybrid.
Ashburn.
Australian.
Australian O. K.
Badger.
Bailey.
Bally Amber (M).
Baltimore.
Beal.
Beal (K).
Bearded King.
Bearded Monarch.
Bearded Monarch (K).
Bennett.
Berwick.
Big English.
Big Frame.
Big May.
Bissel.
Blue Drop (Aus.).
Bodine.
Bordeaux.
Boyer.
Brady.
Brady Lake.
Buckeye.
Bulgarian.
Bullard's Velvet Chaff.
California Blue Stem.
Campbell's White Chaff (Spring).
Canada Club.
Canada Velvet Chaff.
Canadian Express.
Canadian Wonder.
Carter's Bird Proof (Aust.).
Centennial.
Centennial Bearded (M).
Centennial Club.
Champion.
Champion Amber.
Champion Amber (K).
Champion (Aust.).
Clawson.
Clawson (K).
Clawson (M).
Club (Aust.).
Connecticut White.
Cornell No. 3.
Crate.
Crawford.
Currell.
Currell's Prolific.
Currell's Prolific (Ohio).
Dakota (Spring).
Dallas.
Davis.
Deisman's No. 1.
Deisman's No. 2.
Deitz.
Deitz (K).
Deitz No. 28.
Deitz No. 45.
Deitz (Ohio).
Democrat.
Democrat (from Canada).
Diehl Egyptian.
Diehl Mediterranean.

Diehl Mediterranean (O).
Dividend.
Dutoits (Aust.).
Early May.
Early Red (Aust.).
Early Red Clawson.
Early Red Clawson (Ever.).
Early Red Clawson (M).
Early Red Fultz.
Early Rice.
Early Ripe.
Early White Chaff.
Ebersole.
Egyptian (M).
Egyptian (M 71 f).
Emporium.
Everett's Golden Cross.
Everett's Golden Red.
Everett's High Grade.
Everett's New Monarch.
Excelsior.
Extra Early Oakley (K).
Fairfield.
Farquar.
Fenton.
Finley.
French Imperial.
French Prairie.
Fulcaster.
Fulcaster (M).
Fultz.
Fultz Blue Stem.
Fultz Clawson.
Grecian.
Gypsy.
Gypsy (M).
Hackman.
Halfbeard.
Harvest King.
Height's Prolific.
Hertfordshire White.
Hicks.
High Grade.
Hindostan.
Horsford's Pearl.
Hungarian.
Hybrid Dottle.
Hybrid Larned.
Hybrid Larned (Ohio).
Hybrid (M).
Hybrid Mediterranean.
Hybrid No. 9.
Improved Fife.
Improved Rice (D).
Improved (K).
Irish Lamis.
Irish Lamis (M).
Jacques.
Jennings.
Johnson.
Johnson's (K).
Johnson's Winter Fife.
Johnson's Winter Fife (M).
Jones Winter Fife.
Kenning Loud Red.
Kentucky Red (M).
Kentucky White.
King.
Knapp.
Knapp (Dup.).
Kyle Amber.
Lancaster.
Landreth.
Laumas.
Laumas Red.
Lead's Rust Proof (Aust.).
Lebanon.
Lehigh.
Lehigh No. 6.
Leigh.
Lincoln (Mixed).
Little Red.
Long Berry.
Lost Nation.
Lost Nation (Spring).
Lule Red.
Mammoth.
Mammoth Red.
Manchester.
Manitoba.
Martin's Amber.
Martin's Amber (O).
McCracken.
McCregan.
McGhee's Red.
McGhee's White.
McQuay.
McPherson.
Mealy (K).
Mealy (O).
Mediah.
Mediterranean.
Mediterranean Red Chaff.
Menonite.
Miami Valley Pine.
Michigan Amber.
Michigan Bronze.
Michigan Bronze (M).
Michigan White.
Michigan Wick.
Miller.
Miller's Prolific.
Minnesota Hand Fife.
Miracle.
Missouri.
Missouri Blue Stem.
Mixed Winter Wheat.
Moon.
Mountain White.
Nebraska.
New Australian.
New Long Beard.
New Longberry Red.
New Monarch.
New Nigger.
New Red Wabash (M).
New York Flint.
Nigger.
Nigger bearded (M).
Nol Sommer Kolbern.
Northern Champion.
Oakley Extra Early.

Odessa White.
Ohio Swamp.
O. K.
Ontario.
Ontario Wonder.
Oregon Club.
Oregon (K).
Oregon (O).
Ostrey.
Palestine.
Power's.
Patagonia.
Patagonian Trigo.
Peerless Spring.
Penquite's Velvet Chaff.
Peter Joebrose.
Polish Wheat.
Poole.
Poole (M).
Port Bider Rust Proof.
Porter.
Prize Red Chaff (from Scot.).
Prize Square Head.
Pure Gold.
Pure Scotch Fife.
Purple Straw (K).
Purple Straw (Aust.).
Purple Straw Red (Ga.).
Purple Straw Red (K).
Purple Straw White.
Raub's Black Prolific.
Red Amber.
Red Brazilian.
Red Chaff (Australian).
Red Chaff (Square Head).
Red Clawson.
Red Clawson (M).
Red Cross.
Red Egyptian (M).
Red Fultz.
Red Invicible.
Red Knob (Aust.).
Red Lamas.
Red Lea.
Red Line.
Red May.
Red Russian.
Red Straw (Aust.).
Red Tuscan.
Red Wheat.
Red Wheat No. 3.
Regent.
Rejected.
Reliable.
Reliable (M. A. C.).
Riesen Sommer.
Rio Grande.
Roberts (K).
Rocky Mountain.
Rocky Mountain (K).
Rocky Velvet.
Rogers.
Rogers' Amber.
Rogers' Red.
Rogers' Red (M).
Roscoe.
Royal Australian (K).
Royal No. 5.
Ruby.
Rudge.
Rumsey.
Rural No. 5.
Russian.
Russian May.
Russian Red.
Rust Resisting (Aust.).
Sandormica.
Scotch Wonder (Aust.).
Scott.
Seizure.
Selected Beal.
Selected Beal (Aust.).
Selected Clawson.
Seneca.
Seneca Chaff.
Sheriff.
Shoemaker Clawson.
Sibley's Chaff.
Sibley's Hybrid.
Sibley's New Golden.
Silver Chaff.
Silver Chaff (Bearded).
Smith's Improved.
Smooth Scott.
Soules.
Southern Amber.
Spaulding Red.
Square Head Red.
Standard.
Stem Wedel (Aust.).
Strayer's Egyptian.
Strayer's Longberry.
Strayer's Roumania.
Steward.
Surprise.
Swanth.
Talavera (Aust.).
Tasmanian Red (D).
Tasmanian Red (K).
Theise.
Theiss.
Travis.
Travis (M).
Treadwell.
Triticum.
Tuscan Amber.
Tuscan Island.
Valley (K).
Valley (O).
Valley Amber.
Velvet Chaff.
Velvet Chaff (K).
Velvet Pearl (Aust.).
Walker.
Walker's Favorite.
Ward's Prolific (Aust.).
Washington.
Washington Glass.
Wayne.
Wayne Co. Select.
White Blue Stem.
White Chaff.

White Clawson.
White Eldorado.
White Essex.
White Fultz.
White Hagan (Aust.).
White Mexican.
White Mountain.
White Petantille.
White Rogers.
White Rose.
White Samas (Aust.).
White Square Head.
White Surprise.
White Surprise (M).
White Track.
White Tuscan.
White Velvet.
White Wheat No. 1.
White Wheat No. 2
Wild Grove.
Willets.
Willets' Selected.
Wintergreen.
Winter Pearl.
Wisconsin Triumph.
Witter.
Wyandot Red.
Wyson.
Yellow Alabama.
Yellow Blue Stem.
Yellow Missouri.
Yellow White Chaff.
Zimmerman.

BOXES FOR DRIED FRUITS AND NUTS AND FOR LARGE FUNGI.

Two cloth-covered boxes convenient for the purpose named above.

PHOTOGRAPHS OF AMERICAN BOTANISTS.

Allen, Timothy F., M. D., 10 E. 36th St., New York City.
Anderson, F. W., Sc. D., Asst. Ed. Amer. Agriculturist, New York City. Deceased.
Arthur, J. C., Ph. D., Purdue Univ., Ed. Bot. Gaz., LaFayette, Ind.
Atkinson, Geo. F., Asst. Prof. Cryptogamic Botany Cornell Univ., Ithaca, N. Y.
Babcock, H. H., M. A., Prin. Chicago Academy. Deceased.
Bailey, L. H., M. S., Prof. Hort. Cornell Univ., Ithaca, N. Y., Carices.
Bailey, W. W., M. A., Prof. Bot. Brown Univ., Providence, R. I.
Barnes, C. R., Ph. D., Prof. Bot. Univ. of Wis., Ed. Bot. Gazette, Madison, Wis.
Bastin, E. S., A. M., F. R. M. S., Prof. Bot., Mater Med. and Mic., Chicago College of Pharmacy, Chicago, Ill.
Beal, W. J., M. S., Ph. D., Prof. of Botany and Forestry, Agr. Coll., Mich.
Botanical Staff, Mich. Agr. Coll. in 1890. —L. H. Dewey, B. S., J. W. Toumey, B. S., C. F. Wheeler, B. S., W. J. Beal, M. S., Ph. D.
Bebb, M. S., 926 Grant Ave., Rockford, Ill. Salices.
Bessey, C. E., M. S., Ph. D., Prof. Bot. Univ. Neb., Bot. Ed. Am. Naturalist, Lincoln Neb.
Bolley, H. L., M. Sc., Botanist Govt. Exper. Sta., Prof. Biol. Agr'l Coll., Fargo, N. Dak.
Brendel, F., M. D., Peoria, Ill.
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Chapman, A. W., M. D., Appalachicola, Fla.
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Cooley, Dennis, M. D., Washington, Macomb Co., Mich. Deceased.
Cooley, Grace E., Instructor in Botany, Wellesley, Mass.
Cook, O. F., Syracuse, N. Y.
Coulter, J. M., Ph. D., Pres. State Univ., Ed. Bot. Gaz., Bloomington, Ind.
Coulter, Stanley, Prof. Biol. Purdue Univ., LaFayette, Ind.
Coville, F. V., A. B., Botanist Dept. of Agriculture, Washington, D. C.
Crozier, A. A., M. S., Ann Arbor, Mich. Botanical Author.
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Darlington, Wm., West Chester, Pa. Deceased.
Davis, C. A., M. A., Prof. Nat. Sci., Alma College, Alma, Mich.
Davis, J. J., M. D., Racine, Wis. Fungi.
Day, David F., Buffalo, N. Y., Pres. Buffalo Society of Nat. Science.
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Eckfeldt, J. W., M. D., West Phila., Pa.
Ellis, J. B., Plainfield, N. J. Fungi.
Emerson, George B., author of "Trees of Massachusetts." Deceased.
Engelmann, George, M. D., St. Louis, Mo. Botanical writer. Deceased.
Farlow, W. G., A. M., M. D., Prof. Cryptogamic Bot. Harvard Univ., Cambridge, Mass.
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Goodale, Geo. L., M. D., LL. D., Prof. Botany Harvard Univ., Cambridge, Mass.
Gray, Asa, M. D., LL. D., Fisher Prof. of Natural History Harvard Univ., Cambridge, Mass. Deceased.
Hallowell, Susan M., Prof. Botany Wellesley College, Mass.
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Harrington, M. W., Ex-Prof. Botany Univ. of Mich., Washington, D. C.
Henderson, Louis F., Olympia, Wash.
Hervey, Rev. A. B., Ph. D., Pres. St. Lawrence Univ., Canton, New York. Botanical author.
Hicks, Gilbert H., B. S., Instructor in Botany, Agricultural College, Mich.
Hill, Rev. E. J., Englewood, Ill.
Hitchcock, A. S., M. S., Prof. Botany State Agric. College, Manhattan, Kansas.
Holm, Theo., Asst. in Botany U. S. Dept. of Agriculture.
Holzinger, J. M., M. S., Asst. Botanist Dept. Agr., Washington, D. C.
Hooker, Henrietta W., Ph. D., Prof. of Botany Mt. Holyoke College, South Hadley, Mass.
Howell, Thos., Arthur, Oregon.
Humphrey, J. Ellis, D. Sc., Prof. Veg. Physiology Agrl. Exp. Sta., Amherst, Mass.
James, T. P., Cambridge, Mass. Mosses. Deceased.
Jones, Marcus E., A. M., Salt Lake City, Utah.
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Kellerman, Mrs. W. A., Columbus, O.
Kelsey, F. D., Sc. D., Prof. Botany Oberlin College, Oberlin, O.
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Langlois, Rev. A. B., St. Martinville, Florida.
Lazenby, W. R., Prof. Horticulture Ohio State Univ., Columbus, O.
Lesquereux, Leo, American Bryologist. Deceased.
Mackloskie, Geo., D. Sc., LL. D., Prof. Biology Princton College, Princeton, N. J.
Massey, W. F., Prof. Hort. and Bot. Raleigh, N. C.
McBride, T. H., Prof. Botany Univ. of Iowa, Iowa City. Ia.
McCarthy, Gerald, B. S., Prof. Botany Agr'l College, Raleigh, N. C.
McDonald, F. E., Peoria, Ill.
Mohr, Chas., M. D., Mobile, Ala.
Morong, Rev. Thomas, Ph. D., Curator Herbarium Columbia College, New York City.
Munson, T. V., M. S., Dennison, Texas.
Newberry, J. S., M. D., LL. D., Late President Torrey Botanical Club. Deceased.
Palmer, E., M. D., National Museum., Washington, D. C.
Pammel, L. H., B. Agr., Prof. Botany Agr. College, Ames, Iowa.
Parry, C. C., M. D., Davenport, Iowa. Deceased.
Patterson, H. N., Oquawka, Ill.
Peck, Charles. H., State Botanist, Albany, N. Y.
Penhallow, D. P., Prof. Botany McGill Univ., Montreal, Can.
Peters, Thomas M., A. M., Moulton, Florida.
Porter, Thos. Conrad, D. D., LL. D., Prof. Biology and Geology. Lafayette College, Easton, Penn.
Prentiss, A. N., M. S., Prof Botany and Arboriculture Cornell Univ., Ithaca, N. Y.
Pringle, C. G., A. M., East Charlotte, Vt. Prince of American collectors.
Redfield, John H., 216 W. Logan Square, Philadelphia, Pa.
Reverchon, I., Dallas, Texas.
Robertson, Chas., Carlinville, Ill.
Robinson, B. L., Ph. D., Curator Harvard College Herbarium, Cambridge, Mass.
Rowlee, W. W., B. L., Instructor in Botany Cornell Univ., Ithaca, N. Y.
Rolfs, P. H., M. S., Botanist of Agr. Experiment Station, Lake City, Fla.

Rusby, H. H., M. D. Prof. Botany College of Pharmacy, New York City.
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Scribner, F. Lampson, Prof. Bot. Univ. of Tenn., Nashville, Tenn.
Seymour, A. B., M. S., Asst. to the Cryptogamic Botanist Harvard Univ., Cambridge, Mass.
Simpson, J. H., Manatee, Fla.
Smith, Erwin F., D. Sc., Asst. in Veg. Pathology U.S. Dept. of Agr'l, Washington, D.C.
Smith, J. Donnell, 505 Park Ave., Baltimore, Md.
Spalding, V. M., A. B., Prof. Botany Univ. of Mich., Ann Arbor, Mich.
Sudworth, Geo. B., Botanist Forestry Division U. S. Dept. of Agric., Washington, D. C.
Sullivant, W. S., Columbus, Ohio. Mosses. Deceased.
Swingle, W. T., M. S., Asst. in U. S. Dept. of Vegt. Pathol., Eustis, Fla.
Tatnall, Edward, Wilmington, Delaware.
Thaxter, Roland, Ph. D., Asst. Prof. Crypt. Bot. Harvard Univ., Cambridge, Mass.
Thomas, M. D., M. S., Prof. Botany Wabash College, Crawfordsville, Ind.
Thoreau, H. D., M. A., Concord, Mass. Deceased.
Thurber, George, M. D., Late Editor-in-Chief Amer. Agriculturist, New York City. Deceased.
Torrey, John, M. D., LL. D., Early American Botanist. Deceased.
Toumey, J. W., B. S., Prof. of Bot. Univ. of Arizona, Tucson, Arizona.
Tracy, S. M., M. S., Prof. Botany Agr. College, Miss.
Trelease, Wm., Sc. D., Director Shaw Botanic Gardens, St. Louis, Mo.
Townsend, David, West Chester, Pa. Deceased.
Underwood, L. M., Ph. D., Prof. Botany DePauw Univ., Greencastle, Ind.
Vasey, Geo., M. D., Late Chief of Dept. of Agriculture, Washington, D. C. Deceased.
Waldron, C. B., M. S., Prof. Arboriculture, Fargo, N. D.
Ward, Lester F., A. M., U. S. National Museum, Washington, D. C. Fossil Plants.
Watson, Sereno, Ph. D., Late Curator Univ. Herbarium, Harvard Univ., Cambridge, Mass. Deceased.
Wheeler, C. F., B. S., Consulting Botanist Exper. Sta. Agri. College, Mich.
Whiting, C. A., M. S., Prof. Botany in Univ., Salt Lake, Utah.
Williams, R. S., Great Falls, Mont.
Williams, Thos. A., M. A., Botanist Exper. Sta., Brookings, So. Dak.
Wilson, Wm. P., Sc. D., Prof. of the Anat. and Phys. of plants Univ. of Penn., Phila., Penn.
Wolle, Rev. Francis, Bethlehem, Pa.

PHOTOGRAPHS OF FOREIGN BOTANISTS.

Baker, T. G., Kew Gardens, England. Filices.
Balfour, J. H. English Botanist.
Bentham, George, Kew Gardens England. Botanical author. Deceased.
Buckman, J., F. R. S., Prof. Botany Royal Agric. Coll., England. Deceased.
Cheeseman, T. F., Curator Museum, Auckland, New Zealand.
Darwin, Charles (at 45 years of age). Botanical author. Deceased.
DeBary, A., Prof. Botany Univ. of Strassburg, Germany. Deceased.
Dyer, W. Thistleton, M. A., Director Royal Gardens Kew, London, England.
Ehrenberg, C. G., Early German Botanist. Deceased.
Hooker, Sir W. J., Director Kew Gardens, London, England. Deceased.
Hooker, Sir J. D., Ex-Director Kew Gardens, London, England.
Lubbock, Sir John, London, England. Botanical writer.
Oliver, D., Prof. Botany Univ. Coll., London, England.
Paxton, Sir Joseph, Chatsworth, England. Botanical writer. Deceased.
Thompson, W. T., Kew Gardens, England.
Wallace, A. R., D. C. L., England. Botanical author.

GROUP OF BOTANISTS.

Taken in Manchester, England, in 1887, on the occasion of the meeting of the British A. A. S.

Top row.—1. W. R. McNab, Dublin; 2. C. Jessen, Berlin; 3. M. Treub, Java; 4. Comte Herm de Solms-Laubach, Gottingen; 5. Dr. Weismann, Berlin; 6. Gaston de Saporta, Aix; 7. J. G. Baker, Kew; 8. E. Ray Lankaster, London; 9. D'Arcy Thompson, Dundee, Scotland.

Middle row.—10. W. T. Thistleton Dyer, Kew; 11. Ferdinand Cohn, Bretan; 12. Ant. de Bary, Strasburg; 13. Wm. Crawford Williamson, Manchester; 14. Asa Gray, Cambridge, Mass.; 15. N. Pringsheim, Berlin; 16. M. W. Caruthers, London; 17. Walter Gardiner, Cambridge.

Bottom row.—18. Frank W. Oliver; 19. Sidney H. Vines, Cambridge; 20. H. Marshall Ward; 21. Charles Bailey, Manchester; 22. Isaac Bayley Balfour, Oxford; 23. F. O. Bower, London; 24. M. C. Potter, Cambridge; 25. Mr. Vaizey.

THE FORESTRY EXHIBIT.

Although the State board authorized me to decline to accept the collection of the State Forestry Exhibit. I sent much of the material saved from the old botanical museum, including two barrels full, six boxes, seven bundles, twenty-three pieces of logs and knots.

We collected for the exhibit fresh specimens of logs and sticks of forty-five species of Michigan trees and shrubs at the request of Hon. C. W. Garfield.

DONATIONS.

Here are enumerated the gifts received for the past year.

From Mr. Whittemore, Grand Ragids, Mich.:
Specimens of "California Bees"—a fungus growth.
From Hon. T. H. Sherley, Louisville, Ky.:
A very large hornets' nest.
From W. J. Sesser, St. Joseph, Mich.:
Nine large photographs taken at Honolulu.
From Prof. C. A. Davis, Alma, Mich.:
Seeds of Cacalia atriplicifolia and Malva sylvestris.
From Woolston & Co., Passaic, N. J.:
Samples of Pedigree Lawn Grass.
From James Fletcher, Ottawa, Canada:
Live plants of Poa sp.?
From Peter Henderson & Co., N. Y. City:
About ten packages of seeds of grasses and clovers for the Columbian exhibit.
From Prof. John Macoun, Ottawa, Canada:
Seventy-four herbarium specimens of Phanerogams.
From Park, Davis & Co., Detroit, Mich.:
Fifteen samples of crude drugs to go with exhibit to Chicago.
From Prof. L. C. Colburn, Laramie, Wyoming:
Four photographs of Pinus contorta on a rock showing large roots.
From F. E. Jordan, Camp Verde, Arizona:
Package seeds of Cleome lutea.
From Prof. Geo. Letterman, Allenton, Mo.:
Twenty-five plants of Aplectrum hiemale
From H. H. Rusby, Columbia College, N. Y.:
Twenty-three grasses and sedges for the herbarium from Bolivia, S. A.
From Prof. S. M. Tracy, Agricultural College, Miss.:
Living plants of Andropagon macrourus and Tripsacum dactyloides.
From John McLaren, Supt. Golden Gate Park, San Francisco, Cal.:
A large box of living plants (prepaid) of Ammophila arundinacea.

I am still under many obligations to my assistants, C. F. Wheeler and G. H. Hicks, for valuable work performed and the great interest they have taken to promote the success of our department. Again I express my thanks to you, Mr. President, for your earnest support in my work at the college.

I am yours truly,
W. J. BEAL,
Professor of Botany and Forestry.

AGRICULTURAL COLLEGE, MICH.,
June 30, 1893.

FARMERS' INSTITUTES.

Sixteen farmers' institutes were held during the winter, viz.: Four long, of ten sessions each, and twelve short ones of five sessions each.

The long institutes were located at Paw Paw, Van Buren county; St. Louis, Gratiot county; Union City, Branch county, and Vasser, Tuscola county.

The short institutes were held at Hart, Oceana county; Fremont, Newaygo county; Scottville, Mason county; Bad Axe, Huron county; Carsonville, Sanilac county; Memphis, Macomb county; Cass City, Tuscola county; Benzonia, Benzie county; Traverse City, Grand Traverse county; Charlevoix, Charlevoix county; Midland, Midland county; Gladwin, Gladwin county; Grayling, Crawford county.

PROGRAMME FOR THE PAW PAW INSTITUTE.

Monday January 16, 7 p. m., Lecture .... President O. Clute.
Life and Education at the Agricultural College.
Illustrated by stereopticon views.
Tuesday, January 17, 10 a. m. Local paper.
11 a. m. Small Fruits .... Prof. L. R. Taft.
1 p. m. The General Purpose Animal . Prof. P. M. Harwood.
2 p. m. Wheat .... P. G. Holden.
3 p. m. The Chemistry of the Kitchen . Prof. F. S. Kedzie.
7 p. m. Lecture .... H. G. Reynolds.
Travels in Europe. Illustrated by stereopticon views.
Wednesday, January 18, 10 a. m. Local paper.
11 a. m. Breeding of Dairy Cattle .... Prof. P. M. Harwood.
1 p. m. Rural Grounds .... Prof. L. R. Taft.
2 p. m. Wheat .... P. G. Holden.
3 p. m. Chemisty of the Kitchen .... Prof. F. S. Kedzie.
7 p. m. Lecture .... Prof. F. S. Kedzie and Prof. P. B. Woodworth.
What the Microscope Reveals. Illustrated by stereoptican views.
Thursday, January 19, 10 a. m. Local paper.
11 a. m. Essentials to Success in Farming .... Prof. P. M. Harwood.
1 p. m. Insects and Diseases .... Prof. L. R. Taft.
2 p. m. Smut in Wheat and in Oats ... P. G. Holden.
3 p. m. Chemistry of the Kitchen .... Prof. F. S. Kedzie.
7 p. m. Local paper.
Lecture .... Pres. O. Clute.

PROGRAMME FOR THE ST. LOUIS INSTITUTE.

Monday, January 23, 7 p. m. Lecture .... Prof. A. J. Cook.
Life and Education at the Michigan Agricultural College.
Illustrated by stereopticon views.

Tuesday, January 24,	10 a. m,	Local paper.	
	11 a. m.	Silos and Silage	Prof. E. A. Burnett.
	1 p. m.	Corn	F. B. Mumford.
	2 p. m.	Maple Sugar	Prof. A. J. Cook.
	3 p. m.	Potatoes	R. J. Coryell.
	7 p. m.	Equine dentistry	Dr. E. A. A. Grange.
	8 p. m.	Lecture	Hon. C. W. Garfield.

Travels in Europe. Illustrated by stereopticon views.

Wednesday, January 25,	10 a. m.	Local paper.	
	11 a. m.	Stock Feeding	Prof. E. A. Burnett.
	1 p. m.	Corn	F. B. Mumford.
	2 p. m.	New insects, etc.	Prof A. J. Cook.
	3 p. m.	Potatoes	R. J. Coryell.
	7 p. m.	Lecture	Prof. F. S. Kedzie and Prof. P. B. Woodworth.

What the Microscope Reveals. Illustrated with stereopticon views.

Thursday, January 26,	10 a. m.	Local paper.	
	11 a. m.	Stock Feeding	Prof. E. A. Burnett.
	1 p. m.	Pedigree Seeds	Mr. F. B. Mumford.
	2 p. m.	Insects	Prof. A. J. Cook.
	3 p. m.	Apples	R. J. Coryell.
	7 p. m.	Schools	Led by Hon. C. W. Garfield.

Programme for Union City was the same as the one for Paw Paw.

Programme for Vassar was the same as the one for St. Louis, except Mr. Gulley took the place of Mr. Coryell.

Prof. Cook, Mr. Gulley and Prof. Mumford attended the institutes at Hart, Freemont and Scottville.

Mr. Holden, Prof. Taft, Mr. Coryell and President Clute attended institutes at Benzonia, Traverse City and Charlevoix.

Mr. Wheeler, Prof. Harwood and Mr. Gladden attended institutes at Midland, Gladwin and Tawas City.

Prof. Harwood, Prof. Grange and Mr. Gladden attended the institute at Bad Axe, and the others in the thumb.

Mr. Gladden arranged for Union City, Paw Paw, Hart, Freemont, Scottville, Benzonia, Grand Traverse and St. Louis.

Mr. Wheeler arranged for Midland, Gladwin and Grayling.

Mr. Gulley arranged for Vassar.

Mr. Butterfield arranged for Bad Axe and other points in the Thumb.

Prof. Harwood responded to requests for lectures on the following topics: "Breeding of Dairy Cattle," "Care and Management of Dairy Cattle," "The General Purpose Animal," "Holstein-Fresian Cattle," "Essentials to Success in Farming," "Milk."

Prof. E. A. Burnett lectured on "Silos and Silage," "Stock Feeding."

Mr. P. G. Holden lectured on "Wheat," "Smut of Wheat and Oats."

Mr. F. B. Mumford lectured on "Pedigree Seeds," "Corn Culture."

Prof. L. R. Taft lectured on "The Orchard," "Small Fruit Growing," "The Vegetable Garden," "Rural Grounds," "Insects and Diseases."

Mr. A. G. Gulley lectured on the "Kitchen Garden," "Home Grounds," "Grafting."

Mr. H. P. Gladden lectured on "Fruit for the Family," "Plan and Care of the Farmer's Door Yard," "Spraying Fruit Crops."

Mr. R. J. Coryell lectured on "Potatoes," "Insecticides and Fungicides."

Mr. C. F. Wheeler lectured on "Weeds."

Dr. E. A. A. Grange lectured on "Equine Dentistry."

In addition to the above Mr. Gladden lectured on "Small Fruits and Potatoes."

The institutes were on the whole well attended and successful in every particular. They are everywhere hailed with satisfaction and the increased appropriations for 1894 will greatly extend their usefulness.

MISCELLANEOUS PAPERS.

FORESTRY.

BY DR. W. J. BEAL.

What is forestry? It is a business, like agriculture, an industry which is concerned in the production of a soil crop. It is the art of managing a wood crop so that it will make the best harvest of timber in the shortest time at the greatest profit. In forestry, unlike agriculture, it takes many years for the crop to mature and the crop is then a complicated one. The above definition is nearly that given by Mr. Fernow.

Forestry in the United States is now in its earliest stages,—in a mixed or chaotic or undeveloped stage. In its most perfect condition, forestry is not a science nor an art, but consists of a dabbling into several sciences and several arts. On its scientific side it touches botany, chemistry, geology, meteorology, physics, geography, entomology; on the art side it touches horticulture, arboriculture, lumbering, protection from fires, etc.

In some parts of Europe, the growth of timber is already well sytematized, but knowledge of the subject in all its details has been a subject of slow growth. More than a hundred years ago, a few alarmists in Europe prophesied an approaching dearth of timber. This agitation helped to induce economy in the use of timber and to delay the evils predicted.

Without giving the strictest attention to a systematic arrangement, let us note some of the chief attainments already acquired by the leading countries of Europe in the management of forests and the methods adopted to accomplish such excellent results.

It would seem that the government ownership and control of much of the forests in the old country gave them a great advantage over our newer country, where "private enterprise" accomplishes almost every thing. There, even the woodlands of corporations, and of individuals are subject to the laws of the country which specify how much may be cut in each year. These laws are enforced by officials well educated for the business. All forests of the country are systematically inspected and reports made concerning their condition and needs. The inspector acts as "a paternal adviser" to all owners of forests. In the words of a recent American Consul to Austria-Hungary, "The owner of forest land in Austria must exercise extraordinary care not to be guilty of trespass upon his own lands." How different the feeling of owners of land in any one of the United States! In the country above referred to a formidable array of forest officials of various grades is maintained, numbering nearly 32,000 persons.

In all of these particulars we must not loose sight of that wages are much lower, and interest on investments much less remunerative than in our country. So far as I can learn, there are no bounties paid for tree planting.

The large number of qualified officials who must pass rigid examination make it possible and even necessary to maintain numerous schools to keep up this supply of skilled men. The encouragement of profitable employment induces pupils to patronize the schools, which give laboratory or practical work, often in the forests as well as lectures in the class room. To some extent these subjects are taught in other schools than those for the special object of educating foresters. These officials are uniformed and act with the discipline of a well managed army. They usually serve for life and are pensioned when too old or otherwise disabled.

By dint of great energy of a very few persons in this country, attention has been called, and often repeated to the greed and dishonesty of men who steal the timber from the public lands—to the evil effects of removing vegetation from mountain slopes. Many instances of the same kind have been enumerated in Europe, where the evil effects remain as a warning to newer countries. The cost of reclaiming some of these waste places has been great. In this reclamation seeds from the scattering trees cannot be relied on to furnish seedlings for the new growth, but nursery-grown stock must be well set and afterward properly cared for. Experience has led to the formation of many rules in relation to forest management. On sandy soil and on steep mountain slopes, timber can only be cut in narrow strips or thinned out. Grazing among timber is never permitted. Stringent rules in regard to igniting fires in or near forests have been enacted and executed.

From 1860 to 1887, France reforested over 250,000 acres of mountain lands at a cost of $30,000,000, the State paying one-half. In 1887, the total annual appropriation for the forestry department of France was $5,000,000. Here we may well take warning. How much more economical it would be to spend a little money now in preventing devastation, than to suffer the consequences for a time and then possibly spend enormous sums in restoring the forests to the mountain slopes!

In Germany about 25 per cent of the entire area is devoted to forests. Of this amount, about 32 per cent is government land, 15 per cent belongs to communities, 1.3 per cent belongs to charitable and other institutions, 2 per cent belongs to corporations, 48 per cent belongs to private parties. Without the supervision of state officials, "a reckless devastation of forests would be the consequence," just the condition of things we are experiencing in most regions of our own free country.

In Germany a written permit must be obtained even to gather a few leaves, to pick berries, herbs or to gather mushrooms.

In the Eifel district, the mountain slopes were reforested and otherwise improved at the expense of the government, though much of the land belonged to communities.

A chief director of forests in Germany, in writing to the United States Consul, says: "You are certainly quite right when you speak of the importance of forest culture for the United States, but allow me to express my belief that no earnest work in that direction will be accomplished there. The culture of the forests proceeds too slowly to suit your countrymen, and the profits are not forthcoming soon enough. In my opinion good results from forest culture can only be had in the United States when the government shall have taken the matter into its own hands." See reports from the Consuls of the United States on Forestry in Europe, 1887.

Dr. Otto von Hagen says: "The forest is a trust handed down to us from past ages, whose value consists not alone in the income derived from wood, but also in the importance which it exerts, through its influence on climate and rainfall, or land culture. Its importance is not merely a question of the present day or of the present ownership, but is also a matter which concerns the future welfare of the people." For these and other reasons, it then becomes a duty to interfere by legislation.

Think of the time required to grow trees of certain species fit to cut for important purposes! In Germany the age for cutting oaks is 150 to 180 years; beach, 100 to 120 years; Scotch fir or birch, 30 to 100 years. For some purposes of course trees are cut when much younger. In the report of our consul to France in 1887, he observes that "Forests are much more easily destroyed than replaced, for in three years, from 1788 to 1791, almost as large an area in France was deforested as has been reforested in the last ninety years, although much attention has been paid to the subject during this time."

The older and more thickly settled countries of Europe have all passed through the stage in which many of our states have but recently passed or are now passing. Their land in most instances was well covered with forests. They cut and fired and wasted as we are doing, and have long been aware of many of the evil effects of this practice.

To what extent shall we learn and profit by their mistakes?

Under the circumstances what can the people of the United States accomplish? In what ways can we best secure a reform in forest management? Legislation in state and nation will accomplish little, until there are enough stalwart persons thoroughly interested to continue under adverse conditions to work for the success of a better management of lands in forests or lands which ought to be covered with forests.

Something may be done by forest commissions, but too much is likely to be expected of them, and, to save expenses, somebody will advocate their abolition—and somebody will sooner or later usually succeed. The value of forestry commissions consists largely in giving advice and in educating the people. Interest will flag for a while, and again revive.

Tree planting on a large and expensive scale is not likely soon to be skillfully conducted so that satisfactory profits will be apparent. But, notwithstanding, trees of every kind, in a great variety of ways and in many places, should be planted, and the sooner the better for us all. Probably not one in a thousand, nor one in ten thousand, now knows enough about the subject to proceed intelligently to take the best care of his forest or to reclothe the land with forest in the most economical manner. Those who try the experiment should be able and expect to wait. Information on numerous points are sought from every quarter pertaining to the subject, and there are very few or none to give sound instruction.

Over a hundred years ago, some one or more persons in Europe were foolish (?) enough to plant a few white pines from North America. In the language of our time they would be known as "cranks," and yet who shall dare place a sufficiently high estimate on the value of that simple experiment, for it has demonstrated that our white pine is one of the best of trees to grow for timber in that country. A much shorter time would have been insufficient for the trial. We need many men in every county of every state who will have enthusiasm and foresight enough to plant a few trees in places where there may be a prospect for growth a long time without molestation. Before these experiments are completed there will be many anxiously waiting to profit by the results.

We live in a comparatively new country where many of our fathers and grandfathers cut, logged and burned the finest of trees to make room for wheat, corn, potatoes and pasture. We have been taught to destroy trees and not to save them—much less to replant. Very naturally there is great indifference in most neighborhoods of our country.

The arguments for preserving the virgin forests of a new country are by no means all on one side, and no one should expect the trees to be preserved. In most cases the profits of holding are too small to pay for the investment.

Michigan once had about 150,000,000,000 feet board measure of standing pine which was believed to be well nigh inexhaustible. Those now living are witnessing the remaining comparatively small tracts in the back counties. Even with what might be considered good management in a thinly inhabited country, where lumber was cheap, it was soon found next to impossible to preserve this timber, however much the owner might desire to do so. In many seasons the fires destroyed as much pine as the woodman's ax. Dead pines must be cut to save them, and the debris was almost sure to burn and the fire spread to the standing trees. To some extent the same condition of things prevail with regard to the "hard wood," or deciduous-leaved trees, those in most cases these are not so likely to be destroyed by fires. In a business way, there are men now spending much time and money in defending their remaining pine lands from fire, and this is done single handed at their own expense. Still more system is needed and the care should be more general than it ever has been.

"The study of European methods and results in forestry by competent men is, of course, highly valued, but it is not enough. It is not even the most important thing for us. Nothing can be very useful to us which is not based upon careful study of the parts and conditions which are peculiar to this country. We should have in time a system of American forestry.—we must have it, indeed, if we are to avoid serious disasters to our national interests and civilization. We cannot import and adopt ready-made European systems or methods. The forestry of this country must be the product of growth, which has yet scarcely begun. It will be developed by continued and wide-spread observation, and by constant comparison of the results of practice. It is necessary to remind ourselves that no useful system of forest management can be originated or created by legislative enactment. There must be considerable special knowledge and considerable national good sense regarding the needs of this country, behind forestry laws, or they will be not only useless, but mischievous." *Garden and Forest*, Vol. 1, p. 26.

It is important to understand the value of great areas of growing trees on the surrounding cultivated land, to know in what respect they check fierce winds, prevent rapid evaporation of moisture or encourage late frosts in spring, but the possession of this knowledge is not likely to induce men to save trees or to plant trees for the benefit of persons owning farms in the surrounding townships or in other counties. Here is one of the best of reasons why the state and nation should take an active part in the management of forests.

It is difficult to induce most selfish persons—and most persons are selfish, to fully understand the results of a timber famine. They have heard more or less of this talk for years, and believe the day is yet far distant when people of this country will suffer very much inconvenience for lack of timber. They argue as timber becomes scarce and more expensive, less of it will be used. We shall burn coal for fuel, and use more iron and steel. Transportation will be cheaper and timber can be transported for long distances. The use of the land to produce various grains, grasses, fruit and vegetables will help to pay higher prices for timber. In the moister portions of our country, forests once occupied the land and when cleared away, seedlings and sprouts in immense quantities immediately sprang up to contend for every foot of available space. In cutting away the valuable timber, there are usually large numbers of "young things" up to six inches or more in diameter, which if protected from fire and other destroyers have already made a fair start toward renewing the forests. Too little care is usually observed in protecting this young growth which is admitted to be of no value at the present time. Because there are no dollars in them now, the proprietor is likely to let them go to waste. In very few instances in moist climates would it be necessary to plant trees started in the nursery.

The writer has several times been asked this question by bright young men of no resources except their active brains and hands: "What is there in this country to encourage a young man who must earn his living as he goes along to make a specialty of forestry? I like the subject, and if I saw a good living in the business I should run the risk and go ahead." I am free to say, that so far, work in this subject seems to be done gratuitously.

A very few persons in our agricultural colleges have done a little in this direction, mainly to call the attention of students to the magnitude and importance of a study of forestry. Before any one of us thought much about trees, except to learn how best to get the most revenue from them in the quickest way possible, the courses of study in the agricultural colleges were replete even to suffocation with subjects of seeming importance.

Elective courses are expensive. The writer has twice given a course of lectures daily for twelve weeks to members of the senior class—or to those who elected forestry. A course on parasitic fungi runs parallel with that on forestry, and only one of the two can be elected. No doubt there have been similar reasons in the other schools to prevent giving more attention to forestry. If we are interested and made the effort we can all find some opportunities for this work.

Lectures at farmer's institutes now largely held in many states afford some opportunity. But here indifference of the hearers induces us to select other subjects. Vividly does the writer call to mind one occasion at an institute in a new county in which he spoke of the importance of preventing forest fires. The first one to lead in the discussion was a farmer living in the neighborhood, who won the applause of the audience when he said of these fires, "They are the best friends we had in clearing up the country."

The more students know about trees, the more they are likely to be interested in this subject. They can in many ways be started in the right road. Help them to recognize the different species, their names, their anatomy and physiology, their rate of growth and geographical distribution, their special uses in the arts and in nature, how to raise trees from the seeds, how to plant and where to plant, and why and especially how to take proper care of them after setting. He who fully understands the structure and functions of roots will never be seen carting living trees with roots exposed to dry wind and sun for miles along the highway.

How do trees grow? How do they prepare for periods of rest? The biology of a tree is full of interest from seed to finish. Set pupils to hunting up the numerous accidents to which trees are exposed. Which trees preserve their green leaves best in the shade?

Observe and note all the trees and shrubs, their distribution, sizes and condition on a definite small area, and present an essay after careful study for a year or more. Study the effects of pasturing a wood lot by noting examples of those pastured and those left to themselves. Try the thermometer and hygrometer, and dig with the spade in the forest, in the meadow and the well-tilled field. Estimate the amount and value of an acre of good, medium or thin forest, and note the time required to produce it. Note the effect of trees as a shelter along the highway, near dwellings, barns and sheds. Select well grown trees for study.

Why are certain trees found growing in swamps and others on dry land? Why are there no pines or cedars in some neighborhoods, and no beeches or maples in others? A study of these topics in a practical, observing way, and changing opinions with some of your most intelligent friends will usually lead to much better results than merely reading the best books that can be procured; though by all means read also.

Besides the means suggested for aiding the cause, there are others. If the programmes were judiciously prepared and well carried out, the celebration of Arbor Day by school children would have a tendency to awaken an enthusiasm among the people, but usually the exercises consist mainly of quotations from literary authors, scraps of poetry, history and sentiment, rather than any substantial information pertaining to the growth and care of trees, or the needs of forestry.

The establishment of an arboretum, even a small one, on some of the farms of enterprising people, and more especially at each agriculture college and experiment station, the planting of groves of all the kinds of trees to be secured in the vicinity of school-houses, will all help educate and interest the people. We cannot soon expect to see an Arnold arboretum even in every state, but the beneficent influence of that garden has already reached thousands of miles. The values of such plantings are many-sided and far reaching. One good move leads to several others.

Associations for securing the protection of certain private natural scenery help to educate every one who sees the reserves or who reads about them.

Botanic gardens containing shrubs and trees are likely to increase in numbers, each good one lending encouragement to others. So of herbaria, and especially of museums of plant products which should contain no end to interesting specimens of timber, not only those which were well grown, but likewise all manner of monstrosities. The writer, a few years ago, collected and placed in position a unique collection of this kind, and considering the cost, it was more attractive than an ordinary museum of fossils, minerals, stuffed animals, skeletons, pickled fish and snakes.

Who can tell the good results likely to occur to forestry from the establishment and maintenance of the Jesup collection in central park?

Garden and Forest, from its first number to the last, for four years has each week contained a sermon on trees. The influence of this journal has certainly been felt. *Forest Leaves*, an occasional sheet sent out by the Pennsylvania Forestry Association, has been useful. Many other first class journals of agriculture, horticulture, engineering, mechanics, lumbering, etc., have more often of late contained wholesome articles on forestry. The *Engineering Magazine* is showing enterprise in this subject.

The report of the *Tenth Census* has been quoted far and near and marked an era in forestry.

Several books have appeared that are worthy of notice, but none of them can be compared with *The Silva of North America* by C. S. Sargent. the first four volumes of which have been published.

In several states, reports have been issued by forestry commission or forestry associations, or special bulletins on the subject have been published by experiment stations.

The American Forestry Association has done something as well as similar associations in several of the states.

The United States government has, through Mr. Fernow, the efficient head of the Forestry Division of the Department of Agriculture, for some years past apparently never become weary in advocating measures of the greatest moment. Bulletins and reports and gratuitous lectures and frequent conferences with congressmen have all been foremost in awakening interest in this subject and inducing wholesome legislation.

From the condition of things, the growth of an interest in forestry must be slow for some time yet, but I anticipate very great changes in the sentiment of our people and the formation of salutary laws by the close of this century.—*The Engineering Magazine*, p. 82, April, 1893.

A FORESTRY FORTUNE.

OUR WEALTH OF COMMERCIAL WOODS.

A POPULAR ACCOUNT OF THE TREES OF MICHIGAN AND THEIR USES.

BY W. J. BEAL, PROFESSOR OF BOTANY, STATE AGRICULTURAL COLLEGE.

From her location among the great lakes in a temperate climate, Michigan long ages ago was destined to be a great state for growing timber. The people of this century know the results.

For many years past, from Maine to Dakota, from the District of Columbia to Kansas, the lumber of white pine has been more universally employed than any other, especially where the lumber was transported. This is because the timber is light, soft, abundant and satisfactory. Its light weight saves cost in transportation; the ease with which it is worked saves labor, from the time the logs are cut in the forest to the time they reach the finished structure. In early days, before railroads were abundant and efficient, in certain localities, whitewood or tulip tree, known in the south as "yellow poplar," took the place of white pine. Until a recent date most of the lumber of white pine and whitewood used in the construction of houses and cabinet ware was covered with paint. This was the fashion everywhere, perhaps encouraged by the lack of variety in the appearance of these two woods, though in limited quantity they are very pleasant to look upon when well finished and properly covered with oil or varnish.

As white pine became less abundant and higher in price, people discovered that there was scarcely any limit to the supply of many other kinds of wood still left, which for most purposes were preferable to pine. It is only a few years since builders and manufacturers fairly realized that lumber of our various broad-leaved trees—mostly hard wood—was very pretty when suitably cut and finished in oil or varnish or with the addition of some slight staining of light or dark, or red, just a little to vary the appearance and bring out the grain to the best advantage.

NEW USE FOR THE BOTANIST.

Veneers cut around a steamed log, then properly dried and finished are a splendid addition to the lumber cut by ordinary methods. Where the medullary rays of the wood are thick enough, as in the oak and buttonwood, or sycamore, what is known as "quarter sawed" lumber is much employed for unpainted furniture, finishing of the interior of houses, etc. With our large number of fifty-six species of commercial woods still increased by many peculiarities of growth of some of them there is an admirable opportunity, now often improved, to see what can be done in "natural finish." In the markets there is no distinction made between several kinds of oak, two of maple, several of ash, poplar and other trees, but the merchant and manufacturer is quick to discern the beauty of knots, burls, crotches, blistered wood, wavy, curly and bird's eye, of fast growth and slow, brittle and tough, heart wood and sap wood. If properly combined for harmony and contrast in an almost endless variety of ways, most charming effects can be produced. Any one who attended the Columbian Exposition must have noticed this in the Michigan furniture and in the specimens of native wood shown in the state forestry exhibit. Think of the splendid veneers and panels from Grand Rapids and the wainscoting and counters surrounding the display of timber. Here no use was made of stains but Berry Brothers' hand labor and varnish left nothing to be desired. The end is not yet, for in the future more and more study will be given the subject; manufacturers will learn more and more about different methods of cutting, seasoning, staining, filling and finishing and make more use of species that are not now found in the markets. They may even resort to the botanist to select for them certain rare or small kinds of trees that usually find their way into the wood pile near the farm house.

OUR LEADING COMMERCIAL WOODS.

The ashes are very useful, pre-eminent among them the white ash, the wood of which is employed for furniture, farm implements, oars, floors, wagon tongues, parts of buggies and sleighs, finishing the interior of houses, railway cars, butter tubs and other purposes. Black ash is very useful in its way and in some respects so nearly resembles the wood last named that novices have been known to buy wagon tongues made of this timber. It is really more valuable, however, to use for other purposes, such as lumber for finishing houses, for furniture and like, barrel hoops, fence rails and hewn timber.

Blue ash is of a lighter color, as we judge from the bark of the tree, is much less common, of slow growth and seldom found in the markets. The timber is quite durable for posts and sills where exposed to alterations of moisture and dry air. The timber is rather brittle, but would add variety for furniture and house finishing. The wood of green ash passes for that of white ash, the wood of red ash goes the same way.

Balsam is an evergreen found in our northern swamps. The trees yield the Canada balsam of commerce. The wood is soft and until lately was thought to be nearly worthless, but it is now much employed for making paper.

Basswood is a well known tree, a favorite with those who keep bees. The wood is soft, but valuable for boxes of buggies, broom handles, heads of barrels, wooden shoes, for certain parts in furniture, for excelsior and for many other purposes.

Birches: The white bark of the canoe or paper birch is well understood, and its uses. The wood is valuable for fire wood, for turning into a variety of objects, such as spools, useful for shoe pegs, useful for lumber, for veneers, etc. This is not the white birch of the Atlantic coast. Cherry birch is a small tree found in swamps, and the wood is like the last above named. Yellow birch is a much larger tree, and is abundant in the northern part of the lower peninsula. The wood makes admirable furniture and takes a slight stain.

Butternut is found in much of the lower peninsula on low land. The wood is soft, of a brown color, and useful for furniture in great variety, finishing the interior of houses, etc. It is a little muddy in color, but veneers cut around the log are most admirable.

CEDAR, CHERRY AND ELMS.

Red cedar does not exist anywhere in abundance. White cedar or arbor vitæ is a favorite ornamental evergreen found in swamps from the center of the lower peninsula northward. The timber furnishes nearly all the telegraph poles of the north; some railroad ties, shingles and is useful for tubs, boats and very durable for fence posts.

Cherry: The red wood of black cherry is famous for furniture, some of it much resembling mahogany. The timber is durable for posts and sills.

Elms: Of these there are three kinds in the State. Probably it is not twenty-five years since the wood of the water, or American elm, when grown on low land in the forest, was considered absolutely worthless. It worked easily, but the plank warped so that you could scarcely make a barn floor that would be sheep tight. The wood is soft or spongy, and when steamed it is easily cut into thin strips, very nice for cheese boxes, baskets, berry boxes, crates and strips for a great variety of uses. Three or four elm baskets can now be made at a cost not exceeding one made of the old fashioned splints of black ash or white ash. True they will not last as long, but they are lighter and a clean one can be had the oftener. New designs have been made for securing the lapped hoops for barrels, so that those of elm are preferred to hoops of black ash for strength and durability.

Smaller trees of this same species of elm, especially when grown on dry land, make tough timber, and are known as "grey elm." This is very valuable for hubs of buggies and is employed where rock elm is now much used. There is still a good deal of American elm left in Michigan, scattered all over the lower peninsula.

Although the timber of rock elm is lighter in weight and not so strong much of it is used in the place of hickory, for certain parts of carriages, frames of boxes, whiffletrees, cutters, etc. In answers very well for certain parts of farm implements. The trunk is usually very straight: the young branches abound in corky ridges. It thrives on rich land from central Michigan northward.

Red or slippery elm is not so abundant. The lumber is rather light, easily split, of a reddish brown color. The timber is quite durable for posts and sills. The wood takes a nice finish, and has not received the notice it deserves.

Hackberry is perhaps as little known as any tree in the State. It grows along streams; the wood is of a yellowish color and useful for a variety of purposes. It is nearly related to the elms.

HEMLOCK, HICKORIES AND MAPLES.

Hemlock is the handsomest evergreen that grows, when small and grown with plenty of room for ornament. For railroad ties, scantling, larger timber, tan bark, roof boards, etc., it is very useful. There are more slivers sticking from rough boards of hemlock than from any other timber we grow. This is one reason why mechanics have heretofore objected to using this kind of timber; but a little rise in the price of pine brings hemlock into prominence, and now mechanics put on their leather gloves and get along very well with hemlock timber.

Hickories: Of these we have the common white-fruited hickory which furnishes most of the nuts in the market; the larger-fruited hichory, in which the nuts have thin shells, and are of a yellow color; the bitternut, pig nut and small fruited hickory. The timber of all these is much alike, and in rapidly grown sticks is especially valuable for ax helves, handles of hammers, spokes, fills and other parts of carriages, in fact in all places requiring strength and elasticity. "Hickory wood makes a hot fire," was one of the wise sayings in the old school reader. Young hickories are coming forward in nearly all portions of the State.

Maples are well known and popular, especially the sugar maple, which is very abundant still in many northern counties. Black maple is also a sugar maple and is often considered a mere variety of the true sugar tree. It is distinguished from the former not by its blacker bark at all, but by its flowers, fruits and leaves. Birdseye, curly and blistered maples are mostly true sugar maples of peculiar growth.

I can hardly ennumerate all the uses for this wood—sugar, syrup, shade trees, fire wood, cabinet ware, flooring, shoe pegs, broom handles, shoe lasts, lumber for many general purposes, wagon axles, parts of wheelbarrows, charcoal, cant hooks, wooden tools in variety, bowls, forks, etc. It bears turning nicely. Red maple and silver leaved maples are both indiscriminately called "soft maple." The latter grows much the faster; the wood is whiter and the tree less likely to produce good saw logs for the mill. The timber is softer than that first named, but is very useful for many purposes.

THE OAK AND THE PINE.

Of oaks we have white, burr, swamp white, chestnut, yellow, red, scarlet, black, pin, scrub, barren, shingle, but in commerce or among woodsmen they are thrown together and known as white oak, red oak and black oak. Of their beauty as trees and their usefulness for timber we can scarcely speak too highly. They furnish tan bark, posts, piles, railroad ties, timber for bridges, frames for freight cars, ships, plow beams and handles, barrel staves, flooring, ceiling, wagon spokes, hubs, fine furniture, etc. On account of the prominent, thick and wide medullary rays, the wood is especially pretty when quarter-sawed or when cut into veneers. There is almost no end to the uses of our oaks. Oaks, white and red are still very abundant in the State.

Pines: Of these we grow three. Jack or scrub pine does not scale very high in size or quality; nor does it cut much of a figure in the commercial world, but when you need timber long, straight, elastic, rather heavy and very pretty, call for red or Norway pine. It is first class for ceiling, floors, piles, timber and joists for bridges.

The world knows and appreciates Michigan white pine for the markets have been supplied with it for half a century or more. The mechanic who runs the plane and handsaw and drives the nails, likes nothing so well as cork pine and have it he will, even at high price. Cork pine is simply an old white pine.

Poplars in our state are the aspen, large toothed aspen, downy, balsam, and the cottonwoods, five in number. The wood of the first two has, contrary to what might have been predicted twenty years ago, been much sought, of late, for making paper.

Of spruces we have the white and black, both good for making paper and for lumber. In former years they supplied the schools with gum, but numerous imitations have driven most of the genuine article from the market.

Sycamore in early days was supposed to be good for little excepting coon trees, the hollow ones for smokehouses or the timber for second class firewood. It warps badly, but for small strips cut with the silver grain it is very pretty and is used for school-room furniture and ceiling mouldings.

Black walnut probably is the royal tree of Michigan, alas now too scarce. It has for a century or more been the standard of excellence for furniture. We are economizing now, employing it in veneers and strips, or by using other woods in its place. I have known large, fine trees to be cut for the crotches, which were sawed into veneers, while most of the logs were used for common lumber, with which to floor the garret or make hog pens.

White wood has always ranked high as a timber for the saw mill, ever since the State was settled. "Clear stuff" was a favorite for barn boards, frames for large buildings, ships, clapboards, doors, sash, floors, wagon boxes, drawers, boxes.

Willows one, two, three or more have attracted much attention for their timber. Before base ball players used such solid and heavy balls, second growth willow made good ball clubs, but now nothing will do but the best white ash.

Tamarack from the swamps, tall and straight and slim, makes excellent poles for politicians, on which to float the party flag. A good deal has been used for corduroy roads, rails, rafters, posts, pickets for fences, fire wood, roof boards, etc.

Above I have given a popular account of our commercial woods. How long they will last depends upon how carefully the supply is husbanded, the number of severe forest fires, or the amounts rolled into log heaps and burned to get rid of them. Those wanting lumber from our forests can find it for some time to come, and they need not fear to call for it. This will make our people value their timber more than ever and tend to economy and the preservation of groves of young stuff in out of the way places. There are other kinds of native trees in Michigan. Chestnut! Did I hear a call for chestnut lumber? We advise you to use pine or oak, as we have only a little in three or four counties in the southeastern portion of the State and do not care to dispose of the whole stock.

NAMES OF TREES NATIVE TO MICHIGAN.

Below is the list. It includes all those which attain a foot or more in diameter, especially when grown farther south. In Michigan we never hear of witch hazel, paw-paw, or dogwood; most of our hawthornes are enumerated as forest trees. With this explanation, we have eighty-nine species of native trees in Michigan:

Alder, Smooth.
Alder, Speckled.
Ash, Black.
Ash, Blue.
Ash, Green.
Ash, American Mountain.
Ash, Elder-leaved Mountain.
Ash, Red.
Ash, White.
Aspen.
Aspen, Large-toothed.
Balsam, Fir.
Basswood.
Beech, American.
Beech, Blue.
Birch, Cherry.
Birch, Canoe.
Birch, Yellow.
Bitternut.
Box-Elder.
Buckeye.
Butternut.
Cedar, Red.
Cedar, White.
Cherry, Black.
Cherry, Red.
Cherry, Choke.
Chestnut.
Coffee Tree, Ky.
Cottonwood.
Crab Apple.
Dogwood, Flowering.
Dogwood, Green.
Elm, American.
Elm, Red.
Elm, Rock.
Hackberry.
Haw, Black.
Hawthorn, Cockspur.
Hawthorn, Fuzzy.
Hawthorn, Punctate.
Hawthorn, Scarlet.
Hawthorn, Smooth.
Hemlock.
Hickory, Big Shellbark.
Hickory, Pignut.
Hickory, Shagbark.
Hickory, Small Fruited.
Hickory, Whiteheart.
Hoptree.
Ironwood.
Juneberry, Alder-leaved.
Juneberry.
Juneberry, Obovate-leaved.
Locust, Honey.
Maple, Black.
Maple, Mountain.
Maple, Silver.
Maple, Red.
Maple, Sugar.
Maple, Striped.
Mulberry, Red.
Oak, Black.
Oak, Burr.
Oak, Chestnut.
Oak, Dwarf Chestnut.
Oak, Laurel.
Oak, Pin.
Oak, Red.
Oak, Scarlet.
Oak, Swamp-white.
Oak, White.
Paw Paw.
Pepperidge.
Pine, Jack.
Pine, White.
Pine, Red (Norway).
Plum, Wild.
Poplar, Balsam.
Poplar, Downy.
Red-bud.
Sassafras.
Sheep-berry.
Spruce, Black.
Spruce, White.
Sumach, Dwarf.
Sumach, Poison.
Sumach, Staghorn.
Sycamore.
Tamarack.
Wahoo.
Walnut, Black.
Whitewood.
Willow, Almond-leaved.
Willow, Black.
Willow Glaucous.
Witch Hazle.

Those wishing other information regarding the forests of Michigan are referred to articles by the author in "Michigan and its Resources, second edition, 1882," and third edition, 1893, or "State Forestry Commission, 1888."

THE PLANTING OF TREES.

BY CHAS. W. GARFIELD.

[Excerpt of an address before Illinois Horticultural Society, Dec. 13, 1893.]

Mr. Garfield said, substantially:

It is not my purpose to tell you anything new, for if I talked with you with that intent, I should feel that some one of you with a nose for digging, had already found much of that I shall have to say in some musty volume issued between the days of Jethro Tulle and the compiler of the admirable volumes of the Illinois Horticultural Society. It is dangerous to label our efforts in the field of horticulture today with a tag of originality, and still I do not hesitate to talk to you upon the theme that has been assigned me, because, no matter what we may know about the theory and practice of planting trees, our every day practice isn't anything to brag of.

The other morning while supplying the furnace with wood I accidently inserted a sliver in my thumb. It was the thumb of my right hand, and not being an expert with my left, I asked a maiden in her teens if she was an adept in taking out slivers. She allowed that she knew how to do it, and with a needle in hand she began on me with the very best of intentions. The result of her endeavors was a great deal of pain on my part, an unnecessarily large hole in the flesh, and after a time the extraction of the sliver. It should have been the work of an instant with scarcely a bit of pain, but because she did not know how to do it, I had the prolonged agony and still retain the scar.

The world is full of illustrations of simple things that are poorly done because of lack of practical ability in the use of theoretical knowledge. The planting of trees is one of the commonest operations of horticulture, and while I do not expect to tell you a new or original thing about it, I do expect to call your attention to a lot of things that if you know you do not practice.

The operations of a man who threshes with a flail may not be of much import to the one who operates a steam thresher, yet it may not be out of place sometimes to consider the fact that many farmers would save money by following the economy of the flail rather than the expense of the thresher. So in tree planting, the methods of the painstaking tree-lover who goes out with his wife and children, and by the exercise of the greatest of care in which all unite, brings from the forest a tree with all its roots intact, and plants it as an adjunct to his home; who in transit carefully protects roots from the sun and wind with a blanket covering; who straightens out every tiny fiber and packs the earth firmly about every root and finally leaves the surface carefully mulched about the tree, may mot be of much moment to the nurseryman, who, with his lightning tree digger loosens a thousand trees in an hour, jerks them from the rows with great rapidity, piles them upon his wagon rack, and takes them, exposed to sun and wind, to the packing shed where they are handled as so many dry fagots. Still I cannot but think that the intelligent ways of the amateur are worth the careful consideration of the professional.

The unit of tree-planting is the seed; it contains the tree in miniature, and if is planted and the right conditions imposed, it will flourish under our hands, and from my experience, I believe that the planting of these units and their care is the most delightful phase of tree planting. It seems a long time for us to wait from the seed to the bearing tree, or tree that adorns our yard, but time passes quickly, and the tree grows rapidly, and before we know it the miracle of growth is accomplished.

In 1878 I planted a thousand yearling trees of Austrian and Scotch Pines, Black Alder, European Larch, American Elm, White Ash, White and Sugar Maples. In five years I was giving to my neighbors the thinnings of the plantation, for ornamental plantings about their dwellings. In a decade, I was furnishing the best of roadside trees for the highway in our road district. Year before last we built a house in the midst of this grove and today the trees are as high as the dwelling.

This simply illustrates how quickly we can begin at the very foundation of tree life and secure results that are not only delightful, but may be remunerative. Some one may suggest that if we all do this the poor nurseryman will have no chance for his life; but I have no expectation of converting communities to my way of thinking, or this way of doing, but the rather, to whet the appetites of the many to inquire after and secure the products of the nurseryman.

The planting of trees presupposes the digging of them, and it is to this matter of digging that I desire to call your special attention for a moment. Care here is of the greatest importance, and I have found it almost impossible to make an ordinary workman understand the value of preserving roots in living trees taken from the ground. I learned an important lesson in methods while studying the careful management of experts in the removal of the large elms at Chicago. In these cases it is desirable that the whole top of the tree remain unchanged, and that the balance between top and root may be perfectly preserved. The importance of preserving the root system is emphasized. Each trunk root with all its divisions and subdivisions is taken out with the utmost care and wound up in canvass to avoid any abrasion in transit. The orders to workmen are imperative, that no roots shall be lost that can possibly be saved by this method. Great trees two feet in diameter and sixty feet in height are removed for miles, and continue their growth as if they had not been moved from their home.

What is true of the necessity of care and intelligent handling of great trees is just as true of smaller ones. The rule is of general application. It is the carelessness in digging trees that is very largely responsible for the great percentage of loss in transplantation.

We perhaps ought not to blame the nurseryman for using the same implement in the same way, to dig a row of Talman Sweets, the roots of which are near the surface, and a row of Northern Spys, the roots of which penetrate far more deeply, because we ourselves are unwilling to pay for the expense of this care, but it is nevertheless true that with different species and varieties of trees, different management is required in their successful removal. The argument of keeping proper balance between top and root, is of very little weight when the root is all gone to begin with, so that we have to remove the top to comport with it. But with both top and root before us, it is desirable to save as much of the former as possible, and to accomplish this and preserve the balance we must necessarily take every precaution to save as nearly as possible, the complete system of the latter. You may think it will not pay to take all these precautions, but look into your own experience and see how much time you have lost, what uneven orchards you have, what dissapointments you have undergone because of your lack of attention to the root of the matter.

It is better to plant fewer trees with no percentage of loss, than to multiply the number and meet with disappointment. I have no patience with a careless man in the nursery or the orchard.

To the intelligent ruralist there is no more delightful occupation than the planting of trees. If intelligence and thoughtful care guide the operation, the success is a most delightful reward, but every error and every bit of carelessness is sure to result in dissatisfaction, and the attraction that should always go with the operation is entirely lost.

I have no sympathy with a man who can plant a good many trees in a day; if the work is done well the quantity is of little moment, and I wish to emphasize the importance of firming the soil about the roots of a newly transplanted tree. The hand and the foot should be inseparably connected with the work.

The time for planting trees has been a matter of discussion through all time, and today there is not a perfect unanimity of thought among the experts. But one point is admitted by all, that others being equal, the tree can be most safely removed when it is most completely dormant in its life, and this time follows very closely upon the falling of the leaf. The shock of transplanting through the loss of certain parts is thus reduced to a minimum, and the season of comparative rest is utilized by the tree in granulating the broken surfaces of the roots so that when activity begins, every exposed surface will be ready to throw out new rootlets to feed upon new soil. It is important then that broken surfaces should be in the best possible condition produced by a clean cut of the knife. With bruised or impaired surfaces germs of decay will rapidly get in their work, and decomposition acts directly against the proper healing of the wound. This is a little matter that we all know about, and still in the hurry of work, when we plant our trees, how few of us act up to our knowledge. It becomes important at times to remove trees even in mid-summer. The rarity of the necessity and the chances that we take, emphasize the importance of the greatest care. Three suggestions I have to make: First, that if possible the day be a moist one; second, that the operation be done quickly, and, third, that every expanded leaf should be removed.

It is a "tradition of the Elders," that Evergreens should be transplanted just as they are springing into growth. There is little warrant for it in the practical experience of the largest planters. The life processes in Evergreens are constantly at work, but the time of successful removal should certainly be when these processes are at their lowest ebb, so that the general rule which applies to other trees is the proper one to observe in the removal of Evergreens.

A good deal has been written of the advantages of night transplanting. While there is little force in the plan, still the same argument that would advocate a dark day would favor a night for transplanting. During the shock of the process, if there is movement of the sap, the hours of comparative rest that can be given the tree, are of importance. To this end, a tree planted at evening twilight stands a better chance for life than one planted at dawn, with a day of bright sunshine before it.

The habit of planting trees is a good one to indulge. We are all of us more or less creatures of habit, and some habits seem to be more catching than others. I wish that the tree planting habit might be a contagious one. It is true that certain phases of tree planting will go through a community, if well started. Who of you does not recall some neighborhood where the Lombardy Poplar has had this run? at one time it even spread over the whole of France. The Elm planting habit, a most delfghtful one, had its day in New England, and now its result is the pride of the whole Yankee nation. The roadside planting of maples has captured whole communities to the betterment of the landscape. Just now in my own state, in many localities, the Box Elder is having its run. A friend of mine living in Chicago is a great lover of shrubs and their employment in landscape effects. He set the example in a most delightful way some years ago. I have watched the result, and today many very beautiful places owe their attractiveness to the fact that their owners followed his good example.

Some of the old trees that we planted in an early day that now give character to our landscape and home places, owe the fact of their existence to the thoughtfulness of some one who planted under tribulation. On my own home farm, a row of Walnuts, that are appreciated not only by the lover of trees, but the boy lover of nuts, is the result of a desire on the part of the first young housewife in the new country to have growing about her the walnuts that she so much missed in departing from her old home. The nuts were planted in the corners of the worm fence, and now, sixty years later, we look back with gratitude upon this fact in early pioneer life.

In my boyhood days, I was told how desirable it was to imitate the habit of Gladstone, to take an ax and chop down a tree as an appetizer for breakfast. I would rather indulge in a boy the habit of planting a tree, rather than its destruction.

One of the most delightful events connected with a trip, some time ago, through England, was a visit to Dropmore, a delightful estate just outside of London. Its characteristic feature is its tree planting. Here are gathered the most attractive trees from all parts of the earth, planted at different times during the last sixty-five years. They are single and in groups, and so arranged as to give the manor from views without, the semblance of a great forest; but once pass through the interior, the visitor finds each species of trees somewhere upon the estate was so arranged as to grow naturally to its full size and perfected beauty. At its base is a label giving its name, its habitat, and the date of the planting. Here I saw a Douglas Spruce, that grandest of all our mountain evergreens, that had been planted in 1839, and now stood at a height of 160 feet with 80 feet in spread of limb, and a diameter of trunk about 4 feet. Other trees of as great importance, but possibly not so striking in appearance, attracted my attention. The facts I had before me, and the illustration of what a definite number of years can do in the growth of trees under favorable conditions, magnified to my mind the importance of intelligence in tree planting.

Did you ever think about the fields of wheat or corn that have occupied your attention for a year, and how soon all relics of them are gone? The fields are planted to something else, the money for the grain that was sold is spent. Possibly you may have a coat or cloak that will last you for a time in remembrance of the work you put into the crop; and possibly a piece of furniture may remain with you some years yet; but this amounts to little as a remembrance of your best exertion put into those growing crops. How different it is in the planting of trees! The orchard that you planted with your boys to help you, will be a fact in the lives of *their* boys for which they will hold you in grateful remembrance.

The trees you selected with care, to embellish your home grounds, the selection and planting of which were matters of interest to the whole household, will remain for generations, growing in beauty and magnifying your work and thoughtfulness.

I go back to my birthplace, and my first thought is of the house. It has changed beyond recognition. I think of the church where I learned my first lesson in religious exercise. Its place is occupied by a more modern structure that I cannot recognize as connected with my own boyhood days. But the Honey Locust that stands in the yard, that I helped to plant, the coming of whose leaves was to me a revelation of beauty, the growth of whose thorns was a menace to my tendency to climb, is there still. I can sit under its branches and feel that in a sense it is my very own, although the land upon which it stands has passed into alien hands. Bountiful treasures of memory are open to me exhibiting so many attractive things connected with boy life upon the farm, that I feel a relationship to that tree. It remains of all the things, that my hands touched, upon the old farm.

I go back to the old school yard of early days; the outlook everywhere is changed. New farm houses on every side; the schoolhouse itself so modernized as to scarcely exhibit a single thing to recall a memory of boyhood days. The old desks, upon which are recorded symbols of my jackknife days, have been removed, and newer ones, unscratched and smooth, have taken their places. The chalk marks made clandestinely upon the walls are gone. I look in vain for something to recall the pleasures of those boyish days. No, not quite in vain, for there stands a Maple tree in the corner of the yard, a tree that I planted with my own hands under the guidance of a good mother, who took us boys to the woods and taught us how to carefully take up a tree and remove it to the school premises. She told us while she taught the lesson in detail, of how it would stand there through all the years of our lives in remembrance of our painstaking efforts. The maple has grown beyond my thought, but it recalls to me the fact that, after it was planted and I had removed from there, my companions of the school ground watered and cared for it, and preserved it until it was so established as to be a monument in my memory.

In teaching the boys and girls the little details which secure success in the planting of a tree, we often forget the seeds we sow in their hearts that shall grow and develop and sweeten their manhood and womanhood. What object in nature is more suggestive of good thoughts than a tree? It is a model of symmetry, of structure and beauty; a monument erected to a beautiful, benevolent thought.

But there are certain economical considerations in tree planting not often dwelt upon. I am occasionly called into court as an expert, to testify as to the value of a tree broken down by a careless teamster; a row of trees taken into the highway in a newly laid out road; an apple tree in full bearing whose value has been destroyed by somebody's misrepresentation of its variety; and I am astonished ofttimes at the figures the result of careful calculation upon known values. But the fact always stands out plainly to my view, that the value does not depend so much upon what has been put into it as to what can be taken out of it. The Rural New Yorker, in a recent issue published answers from experts, giving their estimate of value upon bearing fruit trees. While there was a great variation in the replies, it seemed to me at first that the prices were placed very high; dut when I thought of trees in my own neighborhood, the income from which I knew, trees that had been well planted and well cared for, I was satisfied that these estimates were not exaggerated.

There is a value we do not often consider that can be placed upon the trees that embellish our homesteads. What would you take for the hickory that stands in the pasture, a tree that has stood the perils of storms for a generation. The tree of all trees under which the cattle have gathered during the hot days of summer for shade and rest; the tree that is cherished by every boy in the neighborhood who had gathered fruit from its branches to add to the delights of the winter evenings.

And now that you recollect that great burr oak that stands near the corner of the farm; it was an old tree when you were a boy, it had been a feature of your landscape through all the years of your growth from childhood to youth, from youth to manhood and from manhood to old age. What would you take for it? How hard up would you have to be to accept an offer? You think it almost wicked to consider a money value in connection with it, but it has an economical value in dollars and cents.

And those two maples that stand on either side of the gateway to your home, trees that you planted there in early days, that you have watched in their rapid growth, and enjoyed there all the year, trees that have so often welcomed you when you have returned from other scenes, and are responsible for the suggestion in your own heart, that there in "No place like home." Will you set a value upon them? Will you tell me what you think they are worth?

And there is the elm that stands by the well. It came up there a chance seedling when you were a little boy. Your father said "George, it is strange that this seed should come up here; let's save it and see what will come of it." You watched it, you protected it, you fought for its life, it has grown to comely proportions, you feel that it is not only a part of the home premises, but a part of your very self. What will you take for it? These things are hard to estimate, and still there is a value that would be recognized in the courts, it would be admitted in matters of arbitration, it would be accepted as an added value to the premises.

I have an elm standing at the very corner of our home farm. In wood it is probably worth $5, possibly, for some manufacturing purpose it could be increased to $10: and still I know that it has a value not less than $1,000 to the five acres of land upon which it is the most characteristic feature. The row of maples that my father and I planted along the front of the farm, when I was a lad of thirteen years, is worth for timber, possibly, $50. If they were dug up and removed to the premises of wealthy people at a large expense, for immediate ornamental effects they might bring me $300. Possibly if I should go into the manufacture of maple sugar, I could make them pay an interest anually above the expense of sugar making upon even a larger sum than this, but their value in cash as an accompaniment of the farm that makes it attractive to would-be purchasers is at a conservative estimate, $3,000.

Things are worth to us what they will bring, and putting these values upon trees that are well planted help us to understand better, the importance of knowing how to plant trees well. I know of many farms made valuable by thoughtful tree planting, that without it would scarcely be saleable at all. And yet to you and me, when we think of trees that are valuable through association, it seems too low a plan in the estimate of values to consider what they will bring.

In the embellishment of a home; in addition to the attractions of the life that we live; in making us happy with our conditions, the values of trees should be estimated as we estimate beauty of person, goodness of heart, brightness of intellect and purity of motive. He who plants trees for the love of them, who adds to the enjoyments of life by beautifying the earth with their attractions, needs no argument from the bank account or pocketbook to prove the value of his efforts.

Standing on the border of a lovely avenue of walnut trees in the beautiful town of Interlaken, Switzerland, and turning your face to the south, in the horizon is outlined that princess of all snowy peaks that characterize the landscape of the little republic, the Jungfrau. With her dazzling shroud of eternal ice and snow, supported on either side by the Silberhorn and the Schneehorn and with grand mountains on the margins of the foreground, her majestic proportions can scarcely be realized. But she is a cold, immovable, heartless maiden; and while at first view, bathed in the flame of a glorious sunset, one feels like bowing down in worship, she cannot awaken that warmth of feeling in the human heart which life and movement stir into activity. Stand still for a time and allow your eyes to drop from the icy mountain to a relief of land in the immediate foreground, a finely rounded sugarloaf hill completely covered with a mantle of living green with pretty patchwork here and there, of variously tinted groups of deciduous that rest the eye and entrance the vision. This is the Kleine Rugen, a living monument resting upon dead mountain rock, to the memory of Kasthofer, a far seeing Swiss forester who planted here the chief forest trees of Switzerland in the early part of the century, which now completely cover it. A barren ugly hill of dead rock, under the intelligent suggestions of his mind, and the moulding power of his hand, sprang into beautiful swaying life; and an unsightly object standing as a blemish in the otherwise beautiful picture of Jungfrau, was transformed into an area, the attractive beauty of which not only heightened the grandeur of the mountain landscape, but delightfully modified the jagged foreground so as to produce by pleasing contrast, a perfect scene of wondrous beauty. In this bit of thoughtful work on the part of an intelligent forester, I became more impressed than ever before, with the idea of beautifying the waste places of the earth by appropriate planting of trees.

In Germany and the Nethelands one sees the roadside, the lane, the line between farms, utilized with fruit and nut-bearing trees. These take the place of orchards. Why do we always put our orchard accompaniment of the farm in a rectangular piece of ground and discourse so earnestly about the proper distance apart to plant our trees, when we have no trees to mark the line between the farm and that of our neighbor, and the lanes to the back fields are devoid of any sylvan embellishment? I know a farm upon which is one of the most productive orchards in Michigan, upon which the trees are not massed at all; they are along the margins, about the barns, on either side of the lanes and scattered here and there in the corners of the fields, just out of the way of the plow. Aside from the profit secured from the sale of fruit, the farm is beautiful, embellished, and never in my life have I seen orchard trees so well developed, so healthy and so productive.

But you say the lines of trees so planted would steal so much fertility from the fields which they border, that the profit therefrom is reduced. You enforce your argument by exhibiting to me the fact that no crops, except grass, will grow with any satisfaction for a long distance from the trees, so that the value of the farm is thus reduced by cutting off its cropping ability. You argue that this method of planting trees is sentimental and that a hardheaded, sensible farmer will never think of it, and if he did such methods would bankrupt him.

Away with such arrant nonsense. The fence row may be thus transformed into a source of income to the farm, and the land devoted to the lane which was hitherto begrudged, because used only occasionally for travel, is metamorphosed into a debt-paying area of land as profitable as the best upon the farm.

The most beautiful landscapes in the world today, as they may be seen all over England, would have been sacrificed to the growth of wheat, oats, barley and roots, had not a broader policy prevailed. Do not tell me that you cannot afford the fertility that goes into the growth of trees, that may perhaps have no use above the embellishment of your farm. England with her denser population has afforded it, and her farmers have been, and are prosperous communities. We have been tree-slayers in this country long enough. Let the epoch pass with its debts and credits; its monuments of wide areas devoted to the successful cultivation of farm crops are of value in so far as the cultivation is not a despoiling process. The man who clears the ground of every bit of wood, who steals the virgin fertility of the land to swell his bank account, is not a benefactor. I will not breathe too serious a criticism upon him. Let him go. He has done his work according to his intelligence. But now let a new epoch of tree-planting be inaugurated; let our vast areas swept by ruthless winds, be dotted with protecting shields of timber; let our wide stretches of open landscape be embellished again with the attractions of woodland beauty.

I trust the logic of experience in older countries may find a lodgment in our own minds, and we may begin early to rectify the errors into which the inertia of tree-destruction has lead us. This means you and me, not some other fellows in other states.

Have we a bit of waste land along a creek border, let us plant it to forest trees and shrubs. Have we a corner of the farm that will be beautified by the addition of a few trees, let us plant them. Can we put a grove about the barn as a protecting living shield for the stock, can we place a group at the entrance of our premises that will tower grandly by and by, a pride to our grandchildren, a monument to our good sense and thoughtful consideration, let us do it.

By the way, have you ever thought about the value of trees as monuments? If well chosen, they will stand the changes of years better than marble or even granite. Look to the older graveyards that are within your area of vision. Are the slabs of marble standing at various angles in crude shapes and inscribed with cruder characters of any particular credit to those who erected them, or do they awaken any particular pleasure in remembrance of the departed? But some of those trees that have grown up there because of sheer neglect of the premises, are really beautiful, and had they been planted there in remembrance of dear ones gone before, would they not be treasures to those who are left, far beyond the cold marble or the lifeless granite?

I remember, years ago, a newspaper item that asked the question, "Who ate Roger Williams?" and then a description followed of the attempt to disinter the remains of that distinguished pioneer liberal. They found that the root of an apple tree near by had penetrated to the bottom of the grave and following the line of the trunk of the body had bifurcated, taking the line of the lower limbs, and its growth had completely absorbed all there was of the earthly remains of Roger Williams. For generations, men, women and children had enjoyed the fruit of that thrifty apple tree. The question of who ate Roger Williams was certainly a pertinent one. And isn't it a delightful thought that when we have left this tenement, all there is that belongs to earth can be taken up and transformed again into living tissues, the fruits of which can strengthen and delight multitudes of people. In this transformation we know no end. We can trace an immortality that is worthy of a monument, and when the monument itself becomes the means of perpetuating this immortality, is it not glorified? Then why not plant a tree above the grave of the one you loved; it will be a constant reminder of affection, and a delightful tribute to the dead, an attractive symbol to the living.

Don't picture to me a kingdom of Heaven with streets of gold enameled with rubies or saphires. Don't try to make yourself believe that future happiness is dependent upon sitting in a golden rocking chair, even if it is embellished with opals and jasper, but rather, dream out a scheme of Heaven where beautiful, symmetrical trees shall temper the brightness of the sun. Let the immortal praises that perhaps you desire to sing be rendered more sonorous by the delicate sound of the wind pursuing its course through their branches and wafting pleasant harmonies through the fields elysium, and above all things so live up to the ideals of this dream, that you shall be fitted to enjoy such a glorious environment as you have pictured. In order to do this, and that your preparation may be complete, plant lovely trees of the earth about your own premises, bring to yourselves and your loved ones all the attractions that the wide diversity of tree and shrub growth presents to you on every hand. I am not so certain but with this kind of a preparation one could slide into the next world and scarcely feel the transition. Surely he who loves God with all his soul, his mind and strength, will be in harmony with nature's most attractive features; and the love of trees that tipifies all that is noble and beautiful in man, can help to place us in harmony with the great center and source of life.

MICHIGAN STATE AGRICULTURAL SOCIETY.

REPORT OF PROCEEDINGS FOR 1892.

The Michigan State Agricultural Society held its 44th annual fair at Lansing, Sept. 12–16, 1892.

Extended rains interfered greatly with the attendance, but the exhibition, as usual, was large and attractive. At the annual election on Thursday the following officers were elected for 1893:

PRESIDENT—**WILLIAM BALL**, Hamburg.
VICE PRESIDENT—**G. W. BEMENT**, Lansing.
SECRETARY—**I. H. BUTTERFIELD**, Lapeer.
TREASURER—**C. W. YOUNG**, Paw Paw.

EXECUTIVE COMMITTEE.

Term expires January, 1895.

F. L. Reed, Olivet, Eaton Co.
N. J. Kelsey, W. Le Roy, Calhoun Co.
H. R. Dewey, Grand Blanc, Genesee Co.
H. S. Fralick, Grand Rapids, Kent Co.
John Lessiter, Cole, Oakland Co.
H. H. Hinds, Stanton, Montcalm Co.
J. P. Shoemaker, Amsden, Montcalm Co.
F. Hart Smith, Somerset, Hillsdale Co.
E. W. Hardy, Osceola Center, Livingston Co.
Frank Maynard, Jackson, Jackson Co.

Term expires January, 1894.

Eugene Fifield, Bay City, Bay Co.
L. B. Townsend, Ionia, Ionia Co.
F. P. Latta, Battle Creek, Calhoun Co.
M. J. Gard, Volinia, Cass Co.
L. W. Barnes, Byron, Shiawassee Co.
W. P. Custard, Mendon, St. Joseph Co.
H. H. Larned, Lansing, Ingham Co.
M. P. Anderson, Midland, Midland Co.
C. E. Lockwood, Washington, Macomb Co.
W. M. Boyden, Delhi Mills, Washtenaw Co.

EX-PRESIDENTS.

M. Shoemaker, Jackson, Jackson Co.
Charles Kipp, St. Johns, Clinton Co.
E. O. Humphrey, Kalamazoo, Kalamazoo Co.
W. L. Webber, East Saginaw, Saginaw Co.
Geo. W. Phillips, Romeo, Macomb Co.
Philo Parsons, Detroit, Wayne Co.
Wm. Chamberlain, Three Oaks, Berrien Co.
A. O. Hyde, Marshall, Calhoun Co.
T. W. Palmer, Detroit, Wayne Co.
James M. Turner, Lansing, Ingham Co.
John T. Rich, Elba, Lapeer Co.

PROCEEDINGS OF THE EXECUTIVE COMMITTEE AT THE REGULAR WINTER MEETING.

FIRST DAY.

The executive committee met at the Hudson House Monday evening, January 9, 1893, at 8 o'clock. In the absence of President Rich, called to order by Vice President Bement.

Roll called, with the following members present: Bement, Butterfield, Fifield, Townsend, Latta, Gard, Custard, Larned, Anderson, Lockwood, Boyden, Ball, Reed, Dewey, Shoemaker, Smith, Chamberlain, Hyde, Lessiter, Hinds.

Minutes of last meeting read and approved.

The president having sent no communication, the report of secretary was submitted, as follows:

SECRETARY'S REPORT.

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—I respectfully submit the following report of the business of the office of the secretary for the year 1892.

Business orders have been drawn for the payment of accounts to the amount of $7,446.29; to repay loans and interest thereon, $817.62; total, $8,363.91.

Orders for premiums to the amount of $4,005.37. Total premium awards are $10,167.75, leaving a balance of $6,162.38 unpaid.

The following will show the offers and awards of premiums for 1892:

PREMIUMS AWARDED.

Class.	Cattle.	Offered.	Awarded.
1	Shorthorns	Dip. and $384 00	1 Dip. and $354 00
2	Devon	" 384 00	324 00
3	Hereford	" 384 00	301 00
4	Jersey	" 384 00	Dip. and 384 00
5	Galloway and Angus	" 384 00	359 00
6	Holstein-Friesian	" 384 00	Dip. and 334 00
7	Red Polled	" 384 00	369 00
8	Grade cattle	99 00	76 00
9	Fat cattle	210 00	150 00
10½	Milch cows	15 00	15 00
	Total cattle	$3,012 00	$2,666 00

Class.	Horses.	Offered.	Awarded.
12	Standard bred	$355 00	$289 00
13	Roadsters not bred	205 00	117 00
14	Carriage	179 00	104 00
15	All work	292 00	163 00
16	Cleveland Bays	211 00	183 00
17	French Coach	189 00	35 00
18	Percheron	237 00	199 00
19	Clydesdale	237 00	181 00
20	Grade draft	206 00	120 00
21	Sweepstakes, stallions A	190 00	70 00
22	Shetlands	80 00	74 00
	Total	$2,381 00	$1,535 00
	Speed	2,000 00	975 00

Class.	Sheep.	Offered.	Awarded.
23	American Merino	Dip. and $271 00	Dip. $271 00
24	Rambouillet Merino	" 177 00	154 00
25	Leicesters and Lincolns	" 177 00	157 00
26	Cotswold	" 177 00	" 177 00
27	Shropshire	" 271 00	" 243 00
28	Hampshire	" 177 00	177 00
29	Oxfords	" 177 00	78 00
30	Merinos not registered	46 00	44 60
31	Fat sheep	96 00	60 00
	Total	$1,569 00	$1,361 00

Class.	Swine.	Offered.	Awarded.
32	Berkshire	3 Dips. $175 00	3 Dips. $137 00
	Essex	3 " 175 00	3 " 175 00
	Suffolk, etc.	3 " 175 00	3 " 175 00
	Poland China	3 " 175 00	3 " 175 00
	Duroc Jersey	3 " 175 00	3 " 172 00
	Chester White	3 " 175 00	3 " 175 00
	Fat Hogs	31 00	16 00
	Total	$1,081 00	$1,025 00
	Poultry	526 50	359 50

Division F.

Class.		Offered.	Awarded.
35	Grain	$158 50	$130 00
	Roots	182 50	119 50
36	Professional Gardeners	130 00	110 00
37	Flour, meal, etc.	39 00	15 00
	Total	$510 00	$374 50

Division G.

Class.		Offered.	Awarded.
38	Butter, Cheese	$85 00	$30 00
39	Sugar, bread and pickles	73 00	46 00
	Total	$158 00	$76 00

Division H.

Class.		Offered.	Awarded.
	Bees and Honey	$178 00	$174 00

Division L.

Class.	Manufactures.	Offered.	Awarded.
51	Wool, etc.	$54 00	$51 00
53	Leather	121 00	27 00
54	Furniture	202 00	172 00
55	Iron work	35 00	Dip. and 1 00
	Total	$412 00	$251 00

Division M.

Class.		Offered.	Awarded.
59	Jewelry, etc.	4 Dips. and $21 00	Dip. and $5 00

Division N.

Class.		Offered.	Awarded.
60	Painting and sculpture	$606 00	$428 00
61	" amateur	164 00	125 00
	Total	$770 00	$553 00

Division O.

Class.		Offered.	Awarded.
62	Plain needlework	$34 00	$26 00
63	Embroidery	187 00	113 00
64	Crochet and knit	61 00	43 00
	Total	$282 00	$182 00

Division P.

Class.		Offered.	Awarded.
65	Miscellaneous	$105 00	Dip. and $26 00

Division Q.

Class.		Offered.	Awarded.
68	Children's department	$45 00	$30 00

Division R—Fruits and Flowers.

Class.		Offered.	Awarded.
69		$53 00	$40 00
70		90 00	90 00
71		46 00	0 00
72		30 00	10 00
73		39 00	38 00
74		39 00	39 00
75		17 50	0 00
76		33 50	31 50
77		178 75	88 25
78		61 00	Dip. and 56 00
79		80 00	80 00
80		52 00	30 00
81		48 00	14 00
82		71 50	58 00
	Total	$839 25	$574 75
	Total, regular	$11,899 75	$9,172 75
	Speed	2,000 00	975 00
	Grand total	$13,839 95	$10,167 75 And 29 diplomas.

The following shows the entries in each class and division:

Division A—Cattle.

Class.		
1—Shorthorns	56	
2—Devons	40	
3—Herefords	44	
4—Jerseys	116	
5—Galloways and Polled Angus	71	
6—Holstein-Friesians	47	
7—Red Polled	72	
8—Grade	20	
9—Fat cattle	24	
10—Sweepstakes for dairy cows	7	
11—Special Hereford prize	18	
Total		515

Division B—Horses.

12—Standard bred roadsters	75	
13—Roadsters not standard	19	
14—Carriage and buggy horses	42	
15—Horses for all work	30	
16—Cleveland Bays	19	
17—French Coach	3	
18—Percheron and French draft	40	
19—Clydesdale and English shire	18	
20—Draft horses, pedigree not required	17	
21—Sweepstake for stallions	6	
22—Shetland ponies	33	
Speed entries	21	
Total		323

Division C—Sheep.

23—American Merinos	133	
24—Rambouillet Merinos	36	
25—Leicesters and Lincolns	20	
26—Cotswold	53	
27—Shropshire	82	
28—Hampshire	24	
29—Oxford	19	
30—Merinos ineligible to record	15	
31—Fat Sheep	20	
31½—Special for Shropshires	7	
Total		409

Division D—Swine.

32—Berkshire	35	
Essex	66	
Suffolk, Small Yorkshire, etc.	81	
Poland China	98	
Duroc Jersey	53	
Chester White, etc.	78	
Fat hogs	13	
Total		424

Division E—Poultry.

33—Poultry	513	
Total		513

Division F—Grain and Vegetables.

34—Grain	112	
35—Vegetables	161	
36—Professional display	6	
37—Flour, meal and feed	7	
Total		286

Division G—Dairy Products.

38—Butter, cheese, etc.	16	
39—Sugar, bread and pickles	41	
Total		57

Division H—Bees and Honey.

41—Bees and honey	63	
Total		63

Division L—Manufactures.

51—Wool samples	8	
53—Articles of leather	9	
54—Furniture	55	
55—Iron work	6	
Total		78

Division M—Clocks, plated ware, etc.

59—Clocks, plated ware, etc.	3	
Total		3

Division N—Painting, etc.

60—Painting, professional 61—Painting, amateur	241	
Total		241

Division O—Needlework.

62—Plain needle and machine work 63—Embroidery and ornamental needlework 64—Crochet and knit work	331	
Total		331

Division P—Miscellaneous.

66—Miscellaneous articles	12	
66—Household articles	4	
Total		16

Division Q—Childrens' Department.

68—Childrens' department	74	
Total		74

Horticultural Department.

69—Artistic Exhibits of horticultural products	3	
70—General collection of fruits	5	
71— " " " market fruits	4	
72—Special exhibit of apples	1	
73—Special exhibit of peaches	9	
74—Special exhibit of pears	16	
75—Special exhibit of plums	1	
76—Special exhibt of grapes	15	
77—Single plates of fruit	309	
78—Dried, canned and preserved fruits	15	
79—Plants and flowers	9	
80—Plants in pots, professional list	13	
81—Plants in pots, amateur list	6	
82—Cut flowers, boquets, etc	38	
Total		444
Total entries in all departments where premiums are offered		3,774

Five thousand copies of the premium list were printed. A better quality of paper was required and the cost was somewhat more than last year. The advertising obtained will pay for the printing.

Three hundred complimentary tickets were printed by the business committee, of which about two hundred and fifty were issued. The same number of press complimentaries was printed and sent to publishers of newspapers. The fair was advertised to a greater extent than for some years, and the cost was somewhat greater.

There has come into my hands for the society moneys as follows:

From advertising in premium list	$234 85
Stall rent	241 50
Check room	17 50
From loan at bank	491 74
Score card privilege	25 00
Speed entries	537 50
Membership tickets sold	449 00
Lansing Horse Association, rent for 1891	150 00
Hay sold	13 00
Cash received from C. E. Lockwood	75
Total	$2,160 84

which I have paid over to the treasurer in cash and approved orders.

Respectfully submitted,
I. H. BUTTERFIELD,
Secretary.

REPORT OF THE BUSINESS COMMITTEE.

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—The business committee respectfully submits the following report of the business transactions of the society for the year 1892.

Mr. D. M. Stem was engaged to take care of the grounds and buildings, and has been employed since March 15, at $25 per month.

Some paint has been applied to old buildings, improving their appearance. The buildings and fences are in good condition.

Insurance polices for $10,000 on the buildings have been renewed.

Interest has been paid on the note indebtedness of the society to October 1, 1892. The society is under obligations to the Central Michigan Savings Bank, and to the Ingham Co. Savings Bank for rebate of one per cent of interest on notes held at those banks.

The committee lunch room was discontinued, with a saving on expense of meals of $75.00.

The renting of grounds and stables has been in charge of Supt. Larned, and his report will show the proceeds. The secretary and treasurer's report will show the financial condition of the society.

All business accounts, so far as known, are settled.

The indebtedness of the society in notes bearing seven per cent interest from October 1, 1892, is the same as last year, $17,873.81.

The committee obtained January 14, 1892, a loan of $250.00, and June 28 one of $500.00. The interest on the former was $11.90, and on the latter, $9.09.

WILLIAM BALL,
G. W. BEMENT,
I. H. BUTTERFIELD.

STATEMENT OF BUSINESS COMMITTEE IN DETAIL.

WINTER MEETING.

1892.	No. of order.		
Jan. 12.	6	Robt. Smith & Co., printing proceedings of winter meeting	$70 00
25.	7	Jas. A. Green, personal expenses	6 10
June 20.	16	Wm. Ball, personal expenses	8 25
Sept. 15.	24	H. S. Fralick, personal expense	7 50
Sept. 16.	25	J. P. Shoemaker, personal expense	9 60
	27	F. Hart Smith, personal expense	11 50
	31	W. E. Boyden, personal expense	8 30
	45	N. J. Kelsey, personal expense	6 72
	37	W. P. Custard, personal expense	9 32
	38	A. O. Hyde, personal expense	7 20
	41	C. E. Lockwood, personal expense	12 30
	47	M. J. Gard, personal expense	8 88
	55	L. W. Barnes, personal expense	5 70
	58	F. H. Latta, personal expense	8 30
	62	Eugene Fifield, personal expense	9 50
	63	John Lessiter, personal expense	9 30
	64	G. W. Phillips, personal expense	12 43
	65	F. L. Reed, personal expense	6 16
	76	M. P. Anderson, personal expense	12 10
	89	H. H. Hinds, personal expense	9 90
	93	L. B. Townsend, personal expense	6 15
	66	C. W. Young, personal expense	11 15
	42	H. R. Dewey, personal expense	7 50
			$263 86

BUSINESS COMMITTEE.

June 20.	16	Wm. Ball, personal expense	$17 35
Dec. 30.	148	Wm. Ball, personal expense	7 75
			$25 10

PRESIDENT'S OFFICE.

VICE PRESIDENT'S OFFICE.

SECRETARY'S OFFICE.

Sept. 17.	68	I. H. Butterfield, salary	$600 00
	104	I. H. Butterfield, salary	400 00
			$1,000 00

TREASURER'S OFFICE.

Jan. 14.	3	C. W. Young, salary, 1891	$250 00
Sept. 17.	66	C. W. Young, personal expense	20 10
Sept. 16.	36	A. H. Estes, treas. clerk	16 43
	40	E. T. Slayton, treas. clerk, services	13 57
	155	E. T. Slayton, treas. clerk, board	7 00
	59	C. S. Robinson, treas. clerk	5 00
	67	Frank Young, treas. clerk	7 00
	69	E. T. Parks, assist. treas., services and board	35 40
	134	C. W. Young, salary, 1892	250 00
			$604 50

POSTAGE.

Feb. 19.	8	S. Foster, stamps	$5 00
June 20.	15	S. Foster, stamps	10 00
June 28.	17	S. Foster, stamps	10 00
July 7.	114	S. Foster, stamps	10 00
Sept. 20.	122	I. H. Butterfield, stamps and stamped envelopes	72 79
Dec. 31.	151	I. H. Bhtterfield, stamps	9 00
			$116 79

BADGES AND DIPLOMAS.

Sept. 9.	119	H. T. M. Treglown, prize ribbons	$22 95
Dec. 31.	147	Calvert Lithograph Co., 50 diplomas	12 50
			$35 45

EXPRESS.

Feb. 20.	10	American Exp. Co., express on stationery to officers	$4 45
July 28.	126	American Exp. Co., exp. on prem. lists	2 00
Aug. 16.	121	U. S. Express Co., exp. on posters	17 10
July 7.	113	American Exp. Co., exp. on prem. lists	5 45
Aug. 30.	117	American Exp. Co., exp. on bills for posting	23 06
Aug. 31,	122	I. H. Butterfield, sundry express	1 45
Sept. 21.	124	I. H. Butterfield, sundry express	1 00
			$54 51

TELEGRAPH AND TELEPHONE.

Sept. 21.	103	Western Union sundry telegrams	$4 15
Sept. 21.	80	Bell Telephone Co., rent telephones	5 50
Aug. 31.	122	I. H. Butterfield, sundry telegrams	1 28
			$10 93

SWITCHING.

Sept. 30.	128	C. & G. T. R'y., switching 83 cars	$83 00
Sept. 21.	124	I. H. Butterfield, eight switching bills	16 00
			$99 00

ADVERTISING.

Aug. 12.	94	U. S. Printing Co., posters	$210 00
Aug. 11.	108	Fair Pub. House, posters	62 00
Aug. 27.	115	R. O. Davies, 20,000 bulletins	73 00
Sept. 17.	109	J. A. Perry, distributing bills	5 00
Sept. 16.	26	Geo. Fowler, distributing bills	17 80
Sept. 16.	51	F. A. Maher, advertising and expenses	107 00
Sept. 16.	77	Grange Visitor, advertising	7 75
Sept. 16.	81	Michigan Farmer, advertis'g	77 00
Sept. 24.	83	Advertising in newspapers	67 60
Dec. 29.	151	Advertising in newspapers	23 58
Sept. 24.	84	Bill posting, sundry bills	61 70
Sept. 20.	122	I. H. Butterfield, paid posting bills	1 30
Sept. 14.	85	J. H. Keyes, bill posting	4 00
Dec. 29.	152	I. H. Butterfield, sundry bills for posting	7 25
			$724 98

GENERAL EXPENSE.

Jan. 13.	2	Samuel Johnson, sundry bills allowed	$30 30
Jan. 14.	4	Samuel Johnson, bill allowed	12 50
Mar. 14.	11	I. H. Butterfield, preparing reports of 1890 and 1891 for publication	10 00
Mar. 18.	12	C. W. Young, balance due treasurer	22 41
Sept. 15.	22	R. L. Hewitt, judge of election	2 00
Sept. 15.	23	J. A. Mann, judge of election	2 00
Sept. 16.	30	G. W. Donaldson, return of admission	2 50
Sept. 16.	29	P. Milligan, return of admission	1 50
Sept. 16.	28	W. D. Marks, preparing for fish exhibit	20 59
Sept. 16.	34	Gordon & Black, plumbing for fish exhibit	25 66
Sept. 17.	52	Guy Weldon, drawing manure	31 00
Sept. 17.	70	E. A. Bowd, bicycle races	400 00
Sept. 17.	78	John A. Carr, bus. for college cadets	14 20
Sept. 9.	86	J. P. Noyes & Co., snap buttons	9 00
Sept. 17.	90	Lansing Fire Dept., firemen at fair	31 50
Sept. 3.	91	N. F. Jennison, material for Art hall	11 23
Sept. 7.	111	M. D. Elliott, drayage fish ex.	3 00
Aug. 29.	116	J. C. Wade, J. P services	1 50
Sept. 10.	129	M. J. & B. M. Buck, rent of chairs	5 25
Sept. 12.	130	A. H. Whitehead, plaster for closets	2 45
Sept. 21.	124	R. B. Shank, oil	80
Sept. 21.	124	I. H. Butterfield, paid drayage	2 68
Aug. 31.	122	I. H. Butterfield, paid drayage	3 50
Jan. 11.	122	I. H. Butterfield, hack for bus. com., 91	1 00
Dec. 31.	154	I. H. Butterfield, expense to Saginaw	3 00
Sept. 17.	88	H. H. Hinds, expense meeting transportation committee.	9 10
Sept. 16.	57	F. H. Latta, rent of tent for vehicle department	12 35
Sept. 16.	58	F. H. Latta, expense transportation committee	6 60
			$677 62

INSURANCE.

Oct. 15.	135	Geo. A. Dyer, policy $2,000	$30 00
Oct. 15.	136	G. J. Charles & Co., policy $1,000	15 00
Oct. 15.	137	Rowe & Edmonds, policy $2,000	30 00
Oct. 15.	138	Klocksiem & Bailey, policy $1,500	22 50
Oct. 15.	139	E. R. Merrifield, policy $1,500	22 50
Oct. 15.	140	D. J. Gillam, policy $1,000	15 00
Oct. 15.	141	Mott & Ackerman, policy $1,000	15 00
1893.			
Jan. 9.	157	I. H. Butterfield, paid on policy	2 50
			$152 50

LOANS.

Jan. 13.	1	Ingham County Savings Bank note paid given for interest, 1891	$54 89
Sept. 27.	98	Central Mich. Savings Bank, bal. on note	257 03
Sept. 27.		I. H. Butterfield, Secretary, paid on note and interest	243 80
Sept. 27.		I. H. Butterfield, paid note and interest	261 90
			$817 62

INTEREST.

Sept. 27.	99	Central Mich. Savings Bank, interest on notes to Oct. 1, 1892	$605 00
Sept. 27.	100	Ingham Co. Savings Bank, interest on notes to Oct. 1, 1892	665 89
			$1,270 89

BUILDINGS AND GROUNDS.

Jan. 14.	5	D. K. Fuller, balance on horse barn, 1891	$47 47
Apr. 15.	13	D. M. Stem, labor	25 00
Sept. 17.	73	A. Frank White, carpenter	20 85
Sept. 17.	107	J. A. Melius, carpenter	6 46
Sept. 21.	95	C. Alsdorf & Son, paints, brushes, etc.	8 35
Sept. 15.	96	Sabin & Crytes, hardware and tools	16 84
Sept. 27.	97	H. H. Larned, pay roll, labor	240 95
Sept. 17.	106	Lansing Lumber Co., lumber	35 64
Sept. 16.	110	I. H. Butterfield, pay roll, labor	29 12
Sept. 17.	112	I. H. Butterfield, pay roll, labor	6 75
Sept. 8.	120	G. W. Park, evergreens	3 00
Oct. 15.	142	D. M. Stem, labor	25 00
Sept. 13.	132	Capital Lumber Co., lumber.	3 16
Oct. 13.	149	Voisalle & Larose, painting	3 50
Dec. 1.	144	D. M. Stem, labor	25 00
Dec. 3.	145	Thos. Hill, plumbing	10 00
Dec. 19.	146	D. M. Stem, labor	25 00
Oct. 10.	153	Mrs. A. Keating, sewing screens	4 00
Oct. 4.	127	Sherwin-Williams Co., paint	38 63
			$574 72

PRINTING AND STATIONERY.

May 11.	14	Robert Smith & Co., 500 postal cards, notices of races and printing	$6 25
Sept. 17.	101	D. D. Thorpe, printing cards, notices, circulars, etc.	43 80
Sept. 17.	102	Thompson & Van Buren, letterheads, tickets, envelopes	10 00
Sept. 17.	105	Lansing Jour., entry blanks, tickets	37 80
Aug. 11.	108	Fair Pub. House, entry tags, premium cards	15 55
July 7.	118	D. D. Thorpe, premium lists.	264 04
July 7.	118	D. D. Thorpe, envelopes	2 75
Sept. 7.	123	R. O. Davies, 1,000 stall cards	3 50
Sept. 3.	125	R. O. Davies, 1,000 "taken cards"	4 75
Aug. 20.	133	Robert Smith & Co., speed entry cards	5 00
Feb. 19.	9	D. D. Thorpe, stationery for officers	32 50
May 20.	131	Fair Pub. House, envelopes.	8 50
Sept. 20.	122	Brown, Treacy & Co., entry books	10 00
			$444 44

MEAL TICKETS.

Sept. 16.	43	Thos. Elliott, 115 meal tickets	$28 75
Sept. 16.	60	W. L. Reed, 351 meal tickets.	87 75
Sept. 17.	72	D. W. Packard, 124 m'l tickets	41 33
Sept. 17.	73	Shultz & Petty, 200 m'l tickets	50 00
Sept. 21.	79	D. M. Stem, 26 meal tickets	6 50
			$214 33

FORAGE.

Sept. 17.	74	U. D. Ward, 38 tons 1,275 lbs. straw	$154 55
Sept. 16.	31	W. E. Boyden, Supt. expenses	14 65
			$169 20

MUSIC.

Sept. 17.	75	F. W. Prince, band, 4 days	$128 00

MARSHAL DEPARTMENT.

Sept. 17.	87	Chief Marshal, personal expense	$13 20
Sept. 16.	51	F. A. Maher, assistant	10 00
Sept. 16.	143	J. A. Perry, assistant	5 00
			$28 20

GATES.

Sept. 16.	42	Superintendent's personal expenses	$16 68
Sept. 16.	48	Superintendent's pay roll	161 25
Sept, 16.	49	W. P. Tooley, gatekeeper	13 50
Sept. 16.	50	C. R. Alley, gatekeeper	15 34
Sept. 16.	53	W. R. Robinson, gatekeeper	15 34
			$222 11

POLICE.

Sept. 16.	35	Superintendent's personal expenses	$21 05
Sept. 16	44	Superintendent's pay roll	252 75
Sept. 16	56	R. S. Hines, police	2 00
			$275 80

GENERAL SUPERINTENDENT.

Sept. 16.	39	Wm. Ball, personal expenses	$22 70

CATTLE DEPARTMENT.

Sept. 13.	18	A. F. Kelsey, judge, expenses	$3 15
Sept. 15.	19	A. F. Wood, judge, expenses	2 00
Sept. 15.	20	R. Baker, judge, expenses	21 25
Sept. 15.	21	John S. Phillips, assistant, expenses	22 00
Sept. 16.	32	Geo. W. Phillips, supt., expenses	21 20
Sept. 16.	33	M. Miles, judge	20 00
			$89 60

HORSE DEPARTMENT.

Sept. 16.	61	Eugene Fifield, supt., expenses	$17 75
Sept. 16.	61	Eugene Fifield, judge's expenses	34 00
Sept. 16.	61	Eugene Fifield, starting judge	25 00
Sept. 22.	82	J. H. Steiner, membership fee, trotting association	15 00
			$91 75

SHEEP DEPARTMENT.

Sept. 16.	55	L. W. Barnes, supt., expenses	$10 75
Sept. 16.	54	Geo. E. Breck, judge	10 00
			$20 75

SWINE DEPARTMENT.

Sept. 16.	63	John Lessiter, supt. expenses	$16 30
Sept. 16.	46	Sharp Butterfield, judge	7 50
			$23 80

POULTRY DEPARTMENT.

Sept. 16.	41	C. E. Lockwood, supt. exp.	$19 80
Sept. 16.	45	Sharp Butterfield, judge	7 50
			$26 00

AGRICULTURAL DEPARTMENT.

Sept. 17.	65	F. L. Reed, supt. expenses	$4 06

DAIRY DEPARTMENT.

Sept. 17.	71	William Chamberlain, supt. expenses	$14 50

BEE AND HONEY DEPARTMENT.

Sept. 16.	47	M. J. Gard, supt. expenses	$14 83

FARM IMPLEMENT DEPARTMENT.

Sept. 16.	37	W. P. Custard, supt. exp.	$26 82

VEHICLE DEPARTMENT.

Sept. 16.	58	F. H. Latta, supt. expenses	$16 35

MACHINERY DEPARTMENT.

Sept. 16.	93	L. B. Townsend, supt., expenses	$12 45

MANUFACTURERS' DEPARTMENT.

Sept. 17.	76	M. P. Anderson, superintendent, expenses	$12 60

ART DEPARTMENT.

Sept. 16,	25	J. P. Shoemaker, superintendent, expenses	$17 00
Sept. 18.	92	J. Trom, rent of show cases	6 50
Dec. 1.	150	John A. Carr, carriage for assistant	3 00
			$26 50

NEEDLEWORK DEPARTMENT.

Sept. 15.	24	H. S. Fralick, superintendent expenses	$22 00

MISCELLANEOUS DEPARTMENT.

Sept. 16.	38	A. O. Hyde, supt., expenses	$9 95

HORTICULTURAL DEPARTMENT.

Sept. 16	27	F. Hart Smith, superintendent, expenses	$15 00

SUMMARY.

Winter meeting	$263 86
Business committee	25 10
Secretary's office	1,000 00
Treasurer's office	604 50
Postage	116 79
Badges and diplomas	35 45
Express	54 51
Telegraph and telephone	10 93
Switching	99 00
General expense	677 62
Buildings and grounds	574 72
Advertising	724 98
Printing and stationery	444 44
Insurance	152 50
Interest	1,270 89
Meals	214 33
Forage	169 20
Music	128 00
Marshal	28 20
Gates	222 11
Police	275 80
General superintendent	22 70
Cattle department	89 60
Horse department	91 75
Sheep department	20 75
Swine department	23 80
Poultry department	26 00
Agricultural department	4 06
Dairy department	14 50
Bee and honey department	14 83
Farm implement department	26 82
Vehicle department	16 35
Machinery department	16 45
Manufacturers' department	12 60
Art department	26 50
Needlework department	22 00
Miscellaneous department	9 95
Horticultural department	15 00
Total	$7,546 59
Loans for expenses, paid	817 62
	$8,363 91

REPORT OF GENERAL SUPERINTENDENT.

To the President and Executive Committee of the Michigan State Agricultural Society:

The general management of the last fair, under the charge of the different superintendents was of a high order. No friction of any importance was noticeable. Each superintendent seemed to vie with his fellow superintendent to make his department the best managed. The expense in the different departments was very light. The booth department was under the control of H. H. Larnard, of Lansing. A large amount of time was expended in this department, but no expense was charged either for board or time. Besides this quite a sum of money has been expended by him for the society and freely donated.

Credit is also due to G. W. Bement for courtesies, money expenditures and time, and for the use of his horse and carriage several times when needed by the society. No charge against the society appears from Mr. Bement. Too much credit cannot be given to all members of the board for their untiring efforts to make the fair a success. I have no special suggestions to make. I think the society is in good working order as present constituted.

WILLIAM BALL,
General Superintendent.

REPORT OF SUPERINTENDENT OF HORSES.

To the President and Executive Committee of the State Agricultural Society:

The exhibition of horses was not as large in 1892 as in former years; only three hundred and two entries, including thirty-three entries on Shetland ponies. The number of entries in each class, and premiums awarded was as follows:

Class.	Breed.	Entries.	Premium offered.	Premium awarded.
12	Standard	75	$355 00	$289 00
13	Not standard	19	205 00	117 00
14	Carriage	42	179 00	104 00
15	All work	30	292 00	163 00
16	Cleveland bays	19	211 00	183 00
17	French coach	3	189 00	35 00
18	Percheron	40	237 00	199 00
19	Clydesdale and Shire	18	237 00	181 00
20	Draft	17	206 00	120 00
21	Stallions with get	6	190 00	70 00
22	Shetland	33	80 00	74 00
	Total	302	$2,381 00	$1,535 00

The entries in speed class were very light; only twenty-six entries in all the classes.

SPEED.

Entries, 26; entrance received, $537.50; premiums paid, $1,000.

I think cutting out the four-year-old mare in our premium list kept a number of exhibitors away from our fairs, as they could not show four-year-old mares without foal by their side.

I would recommend offering premiums on four-year-old mares, and striking out mare with foal by her side, if we cannot offer premiums on both.

The small number of entries in the speed department was caused by our track being in poor condition, and so many races in other parts of the State, and they only charged five per cent entrance, while we charged ten.

Respectfully submitted,
EUGENE FIFIELD,
Superintendent.

REPORT OF SUPERINTENDENT OF SWINE.

To the Executive Committee of the State Agricultural Society:

The entries in this department were 424, last year 356; amount offered $1,081; amount awarded $1,025, and six diplomas. The exhibits in the following breeds is as follows: Berkshire 35, Essex 66, Suffolks and Yorks 81, Poland Chinas 98, Duroc Jersey 53, Chester Whites 78, fat hogs 31.

Personal expenses of superintendent	$16 30
Paid judge	7 50
	$23 80

The exhibit in this department was much larger than last year and generally of fine specimens of the different breeds. A good feeling prevailed among the exhibitors. Believe the classification in this department is now generally satisfactory. All of which is

Respectfully submitted,

JOHN LESSITER,
Superintendent of Swine.

REPORT OF SUPERINTENDENT OF POULTRY.

Mr. President and Executive Committee of the Michigan Agricultural Society:

Gentlemen—The exhibit of poultry was large and the quality extra, there being 573 entries. Premiums offered, $526.50; amount awarded, $359.50. I have no recommendations to offer.

Very respectfully submitted,

C. E. LOCKWOOD,
Superintendent.

REPORT OF SUPERINTENDENT OF AGRICULTURAL HALL.

DIVISION F, FARM AND GARDEN PRODUCE AND MANUFACTURED PRODUCTS.

Mr. President and Gentlemen of the Executive Committee of the Michigan State Agricultural Society:

Class.	Entries.	Premiums offered.	Awarded.
34	112	$158 50	$130 00
35	161	182 50	119 00
36	6	130 00	110 00
37	7	39 00	15 00

While the exhibition was not a large one, I consider it very good for a year not very good for roots and vegetables.

The display of A. W. Jewett, of field seeds, greatest variety and quality to be considered, was very fine and showed much care and taste in arrangement,

I would take this occasion to thank the professor of the Agricultural College for his assistance on the committee of award.

F. L. REED,
Superintendent.

REPORT OF SUPERINTENDENT OF BEE AND HONEY DEPARTMENT.

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—As Superintendent of Division H, bees and honey, I would report: That there was a greater number of exhibitors of bees and their products than for the two previous years. There was sharp competition in bees of every known breed. The exhibition of honey was large and tastily arranged, making a very attractive and instructive display. There was also a good display of the implements and fixtures necessary for the successful management of the bee and honey business. There seems to be a growing interest in this department, indicated by a large number of beginners seeking knowledge in regard to the management of the business. A number of the exhibitors were kept quite busy a good portion of the time instructing the seekers after knowledge in this important industry. There were 63 entries, and $174 awarded in premiums; $189 was offered. The expenses were $14.83, including hotel bill and railroad fare of superintendent.

All of which is respectfully submitted.

M. J. GARD,
Superintendent of Bees and Honey.

REPORT OF SUPERINTENDENT OF ART HALL.

To the President and Executive Board of the State Agricultural Society:

In submitting this report, I wish to state that the success of the department is due to the able and efficient work of my assistant, Miss Longyear. Through her solicitation many fine exhibits were made by citizens of Lansing. To Miss Longyear and Mr. Moore is due the excellent arrangement of the hall. I am also indebted to Prof. Wise of Olivet and Mr. Foster of Charlotte, who acted as judges. The following are the entries and premiums awarded:

Division M, Class 56—1 entry. No premium.
" N, " 60 and 61—241 entry.
Class 60—premiums offered, $606; awarded, $428.
" 61 " " 164; " 125.

Owing to changes and advancement in art, a general classification and revision of the premium is thought to be advisable, and Mr. Moore of Lansing has kindly offered to submit a draft for same for use of committee.

All of which is respectfullly submitted.

J. P. SHOEMAKER,
Superintendent.

REPORT OF SUPERINTENDENT OF MACHINERY.

To the President and Members of the Executive Committee of the Michigan State Agricultural Society:

I beg leave to report the machinery department was quite well filled. The axhibit from the Agricultural College was the main feature. I would recommend that there be more space set apart for the Agricultural College exhibit and that the shelving and fittings for said exhibition be left for their permanent use.

Respectfully submitted,
L. B. TOWNSEND,
Superintendent.

REPORT OF SUPERINTENDENT OF MISCELLANEOUS DEPARTMENT.

To the President and Executive Committee of the State Agricultural Society:

In our miscellaneous department at last fair there was twelve entries in class 65, four entries in class 66, premiums awarded $26.00, expenses of superintendent $9.95.

I have but one suggestion to offer. If this department is to be recognized in the preparation for any future fair, a place should be assigned to it. At last fair the exhibit was in different buildings, except the marble, stone, tiles, etc., which was outdoors. If a suitable building, with space outside and adjoining, could be assigned to it, it would add much to the convenience of both exhibitors, judges and superintendent.

Respectfully submitted,
A. O. HYDE,
Superintendent.

CHIEF MARSHAL'S DEPARTMENT.

Circumstances over which I had not entire control made it necessary for me to leave the State on Wednesday of the fair week, and therefore my department did not have my personal supervision during the three active days of the fair. This was a source of regret to me, but as before stated I was not responsible for the combination of circumstances.

The expenses of the department were $28.20.

Respectfully submitted,
H. H. HINDS,
Chief Marshal.

On motion adjourned *sine die.*

President elect Ball called the board for 1893 to order. Roll called and the following members answered to their names: President Ball, Vice President Bement, Secretary, and Messrs. Fifield, Townsend, Latta, Gard, Custard, Larned, Anderson, Lockwood, Boyden, Hardy, Reed, Dewey, Lessiter, Hinds, Shoemaker, Smith and ex-presidents Chamberlain and Hyde.

The president presented his address as follows:

Gentlemen of the Executive Committee:

For more than forty years a meeting of the executive committee of the Michigan State Agricultural Society has been held annually to report successes or failures and to make preparations for its next annual exhibition. No meeting of the executive board has ever been confronted with so many peculiar conditions as this one, among which may be mentioned the fact that in order that the society might have a permanent home for its future exhibitions (after having traveled over numerous portions of the State, in its pioneer work), it was put to a large expense in furnishing suitable buildings and appurtenances to accommodate the numerous exhibits yearly made at its fair. In doing this, the society became involved heavily in debt, friends of the society becoming security for such debt. Until the last year the receipts of the fair (since it permanently located) have been sufficient to pay its interest, insurance, premiums and running expenses.

To the very rainy weather during the first days of the last fair is due the failure to make the exhibition a financial success. It was certainly not due to any extravagances in the expense department, for never was more rigid economy observed in nearly every department, as the figures which will be presented by the business committee show. The Columbian, or World's Fair, to be held in Chicago this year, will draw very largely upon the purses of our citizens, of whom so large a number will attend that some doubt is expressed as to the wisdom of this society undertaking to make an exhibition next fall, lest it put the society in debt worse than at present. At the same time the interest is accruing, the insurance must be met, the grounds and buildings kept in order for the future. One of the conditions upon which the society accepted a deed of the grounds of the Central Michigan society was, that it should not encumber the property by mortgage or otherwise. So that while it owns, for its exclusive use and benefit, property (without the buildings upon it), worth from seventy to eighty thousand dollars, it cannot secure a dollar in money upon its value, to relieve itself from the debt incurred to make the property more valuable for fair purposes.

Never in the history of the society was a more creditable exhibition of the agricultural products, the stock in all departments, manufacturers, etc., made than last fall. From the fact that the society could not pay its premiums as it agreed, there would be doubt if exhibitors in sufficient numbers would willingly make another good exhibition without some better assurance than a pledge to pay premiums by the society, which owes 70 per cent of its last awards. A society, like an individual, must have financial standing in order to make a success. With property in its possession worth four times its indebtedness it is powerless to secure one dollar to help itself with.

The above are a few of the conditions which meet us. What shall be done to meet and remedy existing difficulties is one of the important duties devolving upon the committee at this time. Some of the reasons which are responsible for this state of affairs have been mentioned and perhaps some others may be noticed, but what we, as a committee, are to do is to take matters as we find them and see what can be done to put this society in a position to command the respect and confidence of business men exhibitors and the State, the prosperity of which has been vastly augmented by its indefatigable work for the last forty-three years.

To those who are interested in the work of the State Agricultural Society, and who may not be conversant with its objects and aims and somewhat of its past history, a brief statement might be acceptable. As declared by its constitution adopted in 1849 in Lansing, "its object shall be to promote the improvement of agriculture and its kindred arts throughout the State of Michigan." That the "object" spoken of has always been the polar star of the society its past history is ample proof. That its work has been highly successful, let the improvement in all the various fields of agriculture, the improvement in every class of domestic animals, the standing of its agriculture with any other state bear witness. The Michigan State Agricultural Society received its parentage from the legislature and executive department of Michigan. Epaphroditus Ransom, then governor, being its first president, it was given birth officially, dressed in swaddling clothes with a little spending money, under certain conditions, and sent forth on its mission of encouragement and improvement in agriculture, and it has never failed in its duty. The results of its work have been felt in every portion of cultivated Michigan. Stripped in a short time of the little aid advanced in its infancy, it marched forth to manhood unaided, except by the energy and determination of those who from time to time were entrusted to manage its affairs. All of the work done by its managers, except its secretary and treasurer, has been done without remuneration, expenses alone having been paid. It has had times of prosperity and times of adversity. In its periods of prosperity it has been generous to the unfortunate, having sent the fire sufferers of northeastern Michigan $500, with many other acts of charity and benevolence. The State of Michigan has always been in the front in the improvement of her natural advantages in the development of her resources and in the education of her citizens. She has an agricultural college well endowed which is an honor to the State, and for which she pays a large yearly amount in money. She has a State agricultural society which she conceived and brought forth, and started on its road to aid agriculture and instruct her citizens, and it has done its work without pay. It has seen fit to appropriate $100,000 to make an exhibit at the Columbian exhibition. If such an exhibition be made and a creditable one, it will be due in no small degree to the past efforts of the State Agricultural Society in the same line of work. The mission of the State Agricultural Society is not completed, but is in just the height of its usefulness.

By unlooked for circumstances, over which the society had no control, it is now in a crippled condition as to its ability to pay its pledges, made to carry out the designs of the legislature when putting it into existence. The society in some manner must be relieved of her present financial distress, or it must go into oblivion, under a cloud of financial embarrassment. If there has been honest, earnest work performed; if (as all must acknowledge), great good has been accomplished in carrying forward the plans of those who inaugurated the society, it seems to me that the State of Michigan, after carefully reviewing its forty years of successful work, will be only too glad to recognize its value, and pay to this society enough, which is justly her due, to relieve it from its present trouble, and to assist slightly in its future work. Other states are aiding their state societies in this direction, and it is as essential to the future prosperity of agriculture that yearly State exhibitions be made as that money shall be yearly expended for any other educational institution within her borders.

I would suggest that the present legislature be informed as to the actual state of things pertaining to this society, and in a proper manner be asked to give relief by way of financial aid. I am glad to say that the present Governor under the circumstances of one year ago has expressed himself as favorable to such a plan when other expedients fail. From his address of 1892 I quote the following:

"Expenses are down to bed rock and yet the receipts were only a little more than sufficient to pay the expenses of the year including our new building and the interest on the indebtedness, which amounts to no more that it may be reasonably expected will be required in addition to current expenses any year. And it is safe to say that it will require the best efforts of this committee and its successor, to pay current expenses from year to year, and for such improvements and renewals as will be required. This being the case the debt of the society remains unpaid, and the annual interest has become a serious addition to the annual burdens of the society.

"The condition in which we find ourselves is not an exceptional one in the history of fairs. Very few of them indeed have ever been selfsustaining. During the forty-five years of its existence this society has done as well financially and otherwise as any of its cotemporaries. The amount of benefit it has been to Michigan is incalculable. No one of its long list of officers has ever made or attempted to make money out of it; it has been run in the interest of no men or set of men, it has been and is in its strongest and broadest sense the people's fair. It has had the services and counsel of many of the best men the State afforded without money and without price, simply because they believed it was a beneficent society and beneficial to the people, and they gave their services from patriotic motives. It is still the people's fair and there is nothing yet to take its place; its days of usefulness are not passed but it is a critical period in its existence, and I trust we shall not adjourn until some measures are adopted for the extinguishment of the debt and placing it again on its feet. As to what that action shall be is for you to determine. I have always been opposed to asking State aid, but from inquiry I learn that there are very few State fairs that have not received State aid, and very few local fairs that have been self-sustaining. I would prefer some other means of paying the debt, but, if there is no other way out I believe the State at large has received many times the amount of benefit which it will require to put us square with the world again, and if lifted over this crisis will pay it many times more"

The actual indebtedness of the society is substantially as follows: Notes of the Society bearing interest, $17,873.81; deficiency from last year, $5,684. Total indebtedness, $23,557.81.

The present meeting of this committee is of the greatest importance. To the result of its deliberations the prosperity or adversity of the Michigan Agricultural Society may in a large measure depend. If in your wisdom you decide to hold the annual fair, provision will have to be made for its support. If you decide to hold no fair this year, the interest on the society' notes should be provided for, as well as its insurance and other necessary expenses which will accrue. I am happy to say that through the efforts of the business committee, the Ingham Co. Savings Bank and the Central Michigan Savings Bank reduced the interest on the notes one per cent, which is no small item.

Everything pertaining to the management of the fair was well performed. Exhibitors were pleasant and courteous, and have in the main reframed from fault finding at the society's inability to pay its premiums in full.

For the details of last year's work I will refer you to the reports of the secretary and treasurer.

In closing will say that if any plan can be put in operation that will relieve the society from its perplexity without asking State aid, I shall be much gratified. If not, then I advise that the power that created the State Agricultural Society and put it to work be asked for the relief in its present dilemma.

WM. BALL.

SECOND DAY.

Tuesday, January 10, 1893.

Called to order by the President. Roll called, quorum present.

Minutes of last meeting read and approved.

General order called and reports presented as follows:

REPORT OF SUPERINTENDENT OF DAIRY DEPARTMENT.

To the Executive Committee Michigan State Agricultural Society:

Gentlemen—The superintendent of dairy makes the following report:

The whole number of entries in class 38, 16; premiums awarded	$30 00
Clas 39, 41 entries—premiums awarded	46 00
Total premiums	$76 00

The dairy department of the State fair, as shown by the entries, is exceedingly meager, and this great interest of the State is not represented in a creditable manner. There was but one entry of creamery butter, and this was of so poor a quality the committee refused to award any premium. There was a fair display of dairy butter of good quality. Not a cheese or anything pertaining to this branch was represented. Your superintendent would recommend that in the future this department receive more attention, that the superintendent should be selected in view of fitness and should make a special effort to interest the dairymen of the State in the fair and bring out more competition and a better display of their products.

WM. CHAMBERLAIN,
Superintendent.

REPORT OF SUPERINTENDENT OF SHEEP.

Lansing, Mich., January 9, 1893.

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—As superintendent of division C, sheep, I beg leave to make the following report:

Class.	Breed.	No. of Entries.	Premium offered.	Premium awarded.
23.	American Merinos	133	Diploma and $271 00	Diploma and $271 00
24.	Rambouilett Merinos	36	“ 177 00	154 00
25.	Leicester and Lincolns	20	“ 177 00	157 00
26.	Cotswolds	53	“ 177 00	“ 177 00
27.	Shropshires	82	“ 271 00	“ 243 00
28.	Hampshires	24	“ 177 00	“ 177 00
29.	Oxfords	19	“ 177 00	78 00
30.	Unregistered Merinos	15	46 00	44 00
31.	Fat sheep	20	96 00	60 00
	Totals	402	Diplomas 7, and $1,569 00	Diplomas 4, and $1,361 00

Special by American Shropshire Association.—No. of entries, 4; $50 offered; $50 awarded.

Judges expense	$13 50
Personal expense	7 25
Total	$20 75

The number of sheep on exhibition was 440, and the quality generally good, many *very fine* specimens of the different breeds. A very creditable showing for the breeders of Michigan. General good feeling prevailed, with the exception that the accommodations for sheep are quite poor, and some of our best exhibitors feel that they cannot afford to risk their best sheep in such pens, that fine finish of fleece that adds so much to the beauty of the animal, and requires so much labor, time and skill to produce, may be ruined during one storm; and the health and life of the sheep is often in danger.

I recommend that there be some steps taken to provide more suitable pens for sheep.

All of which is respectfully submitted,

L. W. BARNES,
Superintendent.

REPORT OF THE SUPERINTENDENT OF FARM IMPLEMENTS.

Lansing, Mich., Jan. 10, 1893.

To the Officers and Members of the Executive Committee of the Michigan State Agricultural Society:

GENTLEMEN—The exhibit in the farm implement department was large and made a fine display. Every department was well filled except the grain thresher and engines. The manufacturers entered into a contract not to exhibit at any fair in 1892, on account of the World's Fair in 1893.

Entries as follows:

Division I, Class 42—Plows	156
“ “ “ 43—Seeders and planters	42
“ “ “ 44—Haying and harvesting machinery	44
“ “ “ 45—Cleaning grain and feed for stock	76
“ “ “ 46—Implements for tillage	141
“ “ “ 47—Miscellaneous implements	281
Total	740

The good feeling among the exhibitors was unanimous and all well pleased with the kind treatment they received from the executive committee.

Respectfully submitted,

W. P. CUSTARD,
Superintendent.

REPORT OF SUPERINTENDENT OF HORTICULTURAL DEPARTMENT.

To the President and Executive Committee of the State Agricultural Society:

Gentlemen—In submitting report as superintendent of the horticultural department I have the following to offer:

Class 69-76—Entries, 53; premiums awarded	$217 00
" 77-82— " 390; " "	357 75
Total entries, 443. Total premiums awarded	$574 75

The expenses of the department, including railroad fare, board, etc., of superintendent in charge, $15.

All of which is respectfully submitted.

F. HART SMITH,
Superintendent in Charge.

REPORT OF SUPERINTENDENT OF VEHICLES.

The exhibit in this department was very large and fine, attracting marked attention from carriage dealers and especial mention by carriage journals, as the finest exhibit in this State in years.

The two carriage halls were filled to their utmost capacity, and five large tents were also used to contain the exhibit, four furnished by exhibitors and one I furnished for the society at a cost of $12. We were crowded so badly in the halls I was obliged to give less space to Lansing exhibitors than formerly, but they cheerfully acquiesced in this, and the extra tent furnished we cared for all, and they seemed to appreciate our efforts to give them good care.

If the society was in condition to guarantee meetings for some years, several carriage firms, I think, would build commodious halls of their own, thus, without expense to us, relieving the otherwise crowded quarters.

There were over two hundred and fifty vehicles of different kinds shown of a high order, nicely arranged, much pride being taken by exhibitors to make all attractive, and they well succeeded.

Extra	$16 00
Tent	12 00
Total	$28 00

Respectfully submitted,

FRANK H. LATTA,
Superintendent.

REPORT OF SUPERINTENDENT OF GATES.

To the President and Executive Committee of the State Agricultural Society:

Gentlemen—The superintendent of gates would beg leave to report:

The gate system of 1892 was in the main like that of 1891, and fairly successful. Permit me to call your attention again to the fact that in all cases where there is money to be received at the gate the treasurer and superintendent of gates each should be represented, if the present system of "coin" is followed.

Personal expenses of superintendent for 1892	$16 68
Pay roll for all help	205 43
Total	$222 11

Being a saving of $\$20\frac{8}{100}$ from that of 1891 and $\$3\frac{79}{100}$ more than under the old system in 1890.

Respectfully submitted,

H. R. DEWEY,
Superintendent of Gates.

REPORT OF SUPERINTENDENT OF MANUFACTURES.

To the President and Members of the Michigan State Agricultural Society:

Gentlemen—As superintendent of division L, I beg leave to make the following report:

Class 51.	No. entries,	8.	Premiums	awarded	$51 00
" 53.	"	9.	"	"	27 00
" 54.	"	55.	"	"	172 00
" 56.	"	6.	"	"	1 00
" 57-8-9.	"	3.	"	"	0 00
Total	No. entries,	81.	Total premiums	awarded	$251 00

This department never had a larger and better display. Every inch of space was in demand. While we were somewhat crowded we managed to get through, and so far as I was able to learn all were well satisfied.

I was called away on Tuesday, and not able to return during the fair. Through the kindness of Mr. Fralick and others who came to my assistance, I wish to return to them my thanks.

Respectfully submitted,
M. P. ANDERSON,
Superintendent.

REPORT OF SUPERINTENDENT OF FORAGE.

Mr. President and Executive Members of the Michigan State Fair:

Gentlemen—I beg leave to submit report of forage department as follows:

Seventy-seven thousand two hundred and seventy-five pounds of straw used; cost of same at $4.00 per ton, $154.55. Expense of superintendent, including cost of man putting straw in stalls before fair, $14.65.

Cost of straw one year ago, $186.23; No. pounds, 93,000.

All of which is respectfully submitted,
W. E. BOYDEN,
Superintendent.

REPORT OF SUPERINTENDENT OF NEEDLE-WORK AND CHILDREN'S DEPARTMENT.

Grand Rapids, Mich., Jan. 7, 1893.

To the Honorable President and Members of the Executive Committee:

Gentlemen—I herewith present to you my report of divisions O and Q (needle-work and children's department), at the last annual fair in Lansing, Sept. 12 to 16, 1892:

Division O.—Whole number of entries, 331. Amount of premiums offered, $258.00. Amount awarded, $182.00.

Division Q.—Whole number of entries, 74. Amount of premiums offered, $45.00. Amount awarded, $30.00.

While the display in these departments was not as large last year as formerly, the class of work shown was superior. At the last annual meeting the premium list of divisions O and Q was thoroughly revised and seemed to give general satisfaction, therefore I would recommend that there be no changes made for this year.

Yours respectfully,
HENRY S. FRALICK.

REPORT OF SUPERINTENDENT OF POLICE.

Marshall, Mich., January 9, 1893.

To the President and Executive Committee of the Michigan State Agricultural Society:

Gentlemen—The police department for the State fair of 1892 was conducted from start to finish on as economic plans as was consistent with good service.

A few tried men went on duty the 10th and others put on the roll only when their services were actually required.

The attendance being small Tuesday and Wednesday on account of the severe storm, a part of the police force was set to work building fence and making other repairs about the grounds.

The Honorable the mayor and recorder of the city of Lansing visited the grounds when required for the purpose of swearing in the men, and merit our thanks for their courtesy. As also the city marshal, who assisted us in preserving order.

The men on the police force were paid $1.50 per day, meals and lodging, *such as we had*, furnished also.

A few policemen obtained lodging in private houses during the time of the fair, but no such bill for lodging has been paid by me, nor is the society in any way accountable for the same.

Messrs. Strong and Bates rendered efficient service by being at the right place at precisely the right time; also the entire force are deserving of mention, being courteous and efficient in the discharge of their duty.

The receipts from fence jumpers were $10.45, which I turned over to the treasurer of the society. A falling off in receipts from this source assures us of a disposition on the part of the public in general to patronize the front gate.

The best of order prevailed on the grounds during the entire fair, and no complaints of loss from pickpockets were heard.

The entire expense of the police department for 1892 was $275.80, which includes, in addition to the regular pay roll, my *personal* expenses, and also a guard over the gates, which I found unprotected at the close of the last day of the fair. This total sum, however, I am pleased to say, is $43.75 less than the expense of the department in 1891, which in turn was $56.71 less than that of 1890, showing that in keeping with the policy adopted by the officers of the society the strictest economy has been observed.

Respectfully submitted,

NEWELL J. KELSEY,
Superintendent.

Mr. Reed moved that the matter of holding a fair in 1893 be referred to the business committee with power to act.

Adopted.

On motion of Mr. Anderson, the regular order of proceeding was ordered, and the president appointed premium list committee as follows: Fifield, Boyden, Dewey, Lessiter, Bement, Barnes and Hyde.

On motion of Mr. Larned, a committee of five, consisting of Messrs. Chamberlain, Hinds, Larned, Custard, Latta, were appointed to take into consideration the financial condition of the society and report at its earliest convenience.

Adjourned to 2 o'clock p. m.

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2 o'clock P. M.

Executive committee met, called to order by the president. Quorum present.

The special committee reported as follows:

Report of the special committee on the financial condition of the society:

To the President and Executive Committee of the Michigan State Agricultural Society:

Your committee appointed to make recommendations for action of the executive committee would make the following recommendations:

1. That no Michigan State Fair be held in 1893.
2. That the State legislature be asked to appropriate annually $\frac{1}{100}$ of one mill per cent of the equalized assessed valuation of Michigan to aid in paying the annual premiums.

3. That the State legislature be asked to enact a law by which the State may acquire a title in fee simple to the present fair grounds, and in consideration therefor to appropriate a sum sufficient to discharge the present indebtedness of the society.

The last proposition to be alternate, this committee favoring the first proposition as most likely to prevail, and offering the most favorable plan for permanent relief.

This committee also recommends the appointment of a legislative committee of five.

WM. CHAMBERLAIN,
H. H. HINDS,
W. P. CUSTARD,
F. H. LATTA,
H. H. LARNED, except as to deciding now the question of holding a fair in 1893.

The proposition to ask the legislature to appropriate one one-hundredth of one mill per cent on assessed valuation of the State was adopted.

The third proposition was adopted as an alternative proposition.

The appointment of a legislative committee was ordered.

Mr. Hinds moved that the recommendation not to hold a fair in 1893 be adopted.

Mr. Smith moved as a substitute that the time of holding the next fair be left to the business committee.

Adopted.

On motion, the president was made member and chairman of the legislative committee.

The president appointed Messrs. Anderson, Smith and Hyde finance committee.

Mr. G. W. Bement was elected general superintendent. H. H. Hinds was elected member of business committee.

The report of the business committee, secretary and superintendent of booths was referred to the finance committee.

Mr. Chamberlain moved that all committees and superintendents be appointed as usual.

On motion, took recess to 7:30 p. m.

Re-convened at 7:30 p. m.

The finance committee reported that they had examined the report of the superintendent of booths and found it correct.

The premium list committee reported.

The treasurer reported as follows:

TREASURER'S REPORT.

Paw Paw, Mich., Jan. 10, 1893.

To the Executive Committee Michigan State Agricultural Society:

GENTLEMEN—I herewith submit my report as treasurer of this society:

RECEIPTS.

Received from H. H. Larned	$1,756 95	
" " S. Johnson, former Secretary	508 10	
" " I. H. Butterfield, Secretary	2,160 98	
" " membership	36 00	
" " N. J. Kelsey, police	10 20	
" cash at Central Michigan Savings Bank	250 00	
" gates and grand stand	8,673 08	
		$13,395 31

DISBURSEMENTS.

Paid on business orders	$8,415 23	
" premium checks	4,388 24	$12,803 47
Balance on hand		$591 84

Respectfully submitted,
C. W. YOUNG,
Treasurer.

The report of the committee on premium list was adopted.

The report of the committee on rules was adopted.

The committee on legislation were appointed as follows: Wm. Ball, W. L. Webber, Wm. Chamberlain, John Lessiter, H. H. Hinds, Henry S. Fralick.

To the President and Gentlemen of the Michigan State Agricultural society:

Your committee to whom was referred the accounts of the Secretary and treasurer aud superintendent of booths have made a careful examination of papers and vouchers, checking them off with the stubs, and find their reports as rendered correct.

M. P. ANDERSON,
F. HART SMITH,
A. O. HYDE,
Committee on Finance.

REPORT OF SUPERINTENDENT OF BOOTHS AND RENTS.

Lansing, Mich., Jan. 9, 1893.

To the President and Directors of the Michigan State Agricultural Society:

GENTLEMEN—Your department of booth and privileges received during the year 1892 as follows:

From rent of stalls	$68 50
" sale of pasturage	91 95
" miscellaneous	85 00
" fair	1,511 50
Total	$1,756 95

A report of receipts in detail are attached hereto; also your treasurer's receipts for $1,756.95. There are no expenses to the society for this department for the year 1892.

Respectfully submitted,
H. H. LARNED,
Superintendent Booths and Privileges.

The President appointed standing committees and executive superintendents as follows:

Business Committee—G. W. Bement, Lansing; H. H. Hinds, Stanton; I. H. Butterfield.

Transportation Committee—H. H. Larned, F. H. Latta, L. B. Townsend.

Finance Committee—M. P. Anderson, F. Hart Smith, A. O. Hyde.

Reception Committee—A. O. Hyde, Wm. Chamberlain, G. W. Phillips.

Premium List Committee—Eugene Fifield, W. E. Boyden, H. R. Dewey, John Lessiter, G. W. Bement, L. W. Barnes, A. O. Hyde.

Committee on Rules—F. L. Reed, N. J. Kelsey, J. P. Shoemaker.

Committee on Program—L. W. Barnes, E. Fifield, L. B. Townsend.

Printing and Advertising—Butterfield, Reed, Dewey, Chief Marshal, Eugene Fifield.

General Superintendent—G. W. Bement.

EXECUTIVE SUPERINTENDENTS.

Cattle—W. E. Boyden.
Horses—Road Horses and Speed, L. B. Townsend; Draft and Ponies, C. E. Lockwood.
Sheep—L W. Barnes.
Swine—John Lessiter.
Poultry—Frank Maynard.
Agricultural Hall—F. L. Reed.
Dairy—Wm. Chamberlain.
Bees and Honey—M. J. Gard.
Implements—W. P. Custard.
Machinery—A. O. Hyde.
Vehicles—F. H. Latta.
Manufactures and Music—M. P. Anderson.
Art—J. P. Shoemaker.
Needle Work—H. S. Fralick.
Children's Departm't—H. S. Fralick
Miscellaneous—A. O. Hyde.
Horticulture—F. Hart Smith.
Forage—E. W. Hardy.
Police—N. J. Kelsey.
Gates—H. R. Dewey.
Booths and Rents—H. H. Larned.

On motion adjourned.

I. H. BUTTERFIELD,
Secretary.

EASTERN GENESEE AGRICULTURAL SOCIETY.

ARTICLES OF ASSOCIATION.

In conformity to and by the authority of an act of the legislature of the State of Michigan entitled "An act to authorize the formation of county and town agricultural societies," approved Feb. 12, 1855, and the amendments thereto, the said act as amended being included in chapter seventy-four of Howell's Annotated Statutes and amendments thereto.

We, the undersigned, do hereby agree that the following shall be the articles of association governing us, the undersigned, as a body politic and corporate under the name and for the business and objects in said articles set forth.

ARTICLE I.

This society shall be known as the Eastern Genesee Agricultural Society.

ARTICLE II.

The objects of this society are to promote agricultural pursuits and enterprises, to encourage the improvement of homes, farms, machinery and live stock, and to secure the benefits derived socially and financially from holding annual fairs and exhibitions.

ARTICLE III.

Any person residing in the townships of Davison, Richfield, Atlas, or other townships contiguous thereto, may become a member and stockholder of this society by paying into the treasury thereof, annually, the sum of one dollar and subscribing to these articles of association.

ARTICLE IV.

All fairs, exhibitions, or other entertainments conducted by this society shall be held at the village of Davison on such grounds as the directors of this society may select and provide for the same.

ARTICLE V.

The annual meeting of the stockholders of this society shall be held on the last Monday in October of each year, beginning at ten o'clock a. m. and at such place in the village of Davison as shall be determined by the board of directors.

ARTICLE VI.

Special meetings of the stockholders may be called by the board of directors by publishing a notice of the time, place and objects of such meeting in a newspaper published in the village of Davison and in such other newspapers of Genesee county as they may deem necessary, for at least two weeks before the date of such meeting.

ARTICLE VII.

The officers of this society shall consist of a president, a secretary, a treasurer and nine directors.

ARTICLE VIII.

The president, secretary and treasurer shall each be elected annually by the stockholders of this society at its annual meeting, and at the annual meeting of this society to be held in the year 1894 there shall be elected by the stockholders, nine directors, three for a term of one year, three for a term of two years and three for a term of three years; and at each annual meeting thereafter, there shall be elected three directors for a term of three years each: *Provided*, That until the said annual meeting in the year 1894, the board of directors of this society shall consist of the following named persons to wit: Elmer D. Gardner, Elijah S. Davis, Roscoe J. Groves, Elbert Pettis, Ambrose Cullen, Seymour Smith, Burnett Thomas, Stephen Lobban and Frank Jacques.

ARTICLE IX.

These articles may be amended in the manner prescribed by the statute; and by-laws for the government and management of this society may be adopted at any annual meeting or special meeting called for that purpose, by a majority vote of the stockholders present at such meeting.

In witness whereof we have hereunto subscribed our names this tenth day of November, 1893.

James H. Baxter,
Eugene A. Wallin,
Elijah S. Davis,
Jno. A. Richards,
Jas. F. Rumer,
A. B. C. Hardy,
C. W. Parker,
John F. Cartwight.
E. Pettis,
Lewis Schnorr,
Charles H. Leach,
E. J. Rumer,
L. S. McAllister,
H. C. Dayton,
C. E. Hoyle.
B. Cartwright,
Herbert W. Cole,
J. T. Hurd,
Wm. E. Potter,
A. A. Elmore,

George Burch,
Henry Siple,
E. B. Harvey,
E. E. Miller,
A. F. Bryant,
Geo. W. Bush,
R. N. Potter,
Wm. Hackett,
A. B. Cullen,
Frank Blackmore,
C. S. Moss,
E. J. Hanley,
R. J. Groves,
Clarence Soper,
Fred S. Haynes,
Geo. W. Potter,
H. Langly,
E. D. Gardner,
Lucius Knowles.

John H. Tyler, witness as to all.
Florence E. Tyler, witness as to all.

STATE OF MICHIGAN, } ss.
COUNTY OF GENESEE, }

On this tenth day of November, A. D. 1893, before me, John H. Tyler, a justice of the peace in and for said county, personally appeared James H. Baxter, Eugene A. Wallin, John A. Richards, Jas. F. Rumer, A. B. C. Hardy, C. W. Parker, John F. Cartwright, E. Pettis, Lewis Schnorr, Chas. H. Leach, E. J. Rumer, L. S. McAllister, H. C. Dayton, C. E. Hoyle, B. Cartwright, Herbert W. Cole, D. T. Hurd, Wm. E. Potter, A. A. Elmore, George Burch, Henry Siple, E. B. Harvey, E. E. Miller, A. F. Bryant, Geo. W. Bush, R. N. Potter, Wm. Hackett, A. B. Cullen, Frank Blackmore, C. S. Moss, E. J. Hawley, R. J. Groves, Clarence Soper, Fred S. Haynes, Geo. W. Potter, H. Langley, E. D. Gardner and Lucius Knowles, to me known to be the same persons described in and who executed the above articles of association, who have acknowledged the same to be each for himself, his own free act and deed.

JOHN H. TYLER,
Justice of the Peace.

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